narda Microline®

# INSTRUCTION MANUAL

DIFFERENCE SHEET
FOR
OPERATION AND MAINTENANCE
MANUAL
Model 9530
2.0-18.0 GHz SOLID STATE SWEEPER

MP MASTER
MA23730

PRECISION MICROWAVE AND RF TEST EQUIPMENT 2/71
THE NARDA MICROWAVE CORPORATION, PLAINVIEW, L. I., N. Y. 11803 • 516 GE 3-9000

DIFFERENCE SHEET
FOR
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MANUAL
Model 9530
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98260041

12/71

# SECTION I

## TECHNICAL MANUAL DIFFERENCE SHEET FOR THE MODEL 9530 2.0 - 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR (98260041)

1-1. INTRODUCTION.

1-2. This Difference Sheet specifies the differences between the Narda Model 9530 2.0 to 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR and the 9500 SOLID STATE SWEEPER/SIGNAL GENERATOR.

1-3. The Operation and Maintenance Manual provided with this unit is applicable to the Model 9530 with the changes noted on this Difference Sheet. This Difference Sheet and manual will be superseded in a short time, by the Model 9530 Technical Manual.

1-4. All references to the Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER should be interpreted as Model 9530 2.0-18.0 GHz SOLID STATE SWEEPER/ SIGNAL GENERATOR.

1-5. All references to the frequency range of 1.0-12.4 GHz should be interpreted as 2.0-18.0 GHz.

1-6. DESCRIPTION.

1-7. The Narda Model 9530 2.0-18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR operation and description is identical to the Model 9500 Sweeper.

1-8. SPECIFICATIONS.

1-9. Table 1-1 lists the specifications for the Model 9530 2.0-18.0 GHz SOLID STATE SWEEPER.

Table 1-1

Specifications

| | |
|---|---|
| Frequency Range | 2.0 to 18.0 GHz |
| Resolution | 200 KHz normal<br>50 KHz on FINE control for F1 Digital Display Counter |

Table 1-1 (Cont)

| | |
|---|---|
| Stability (CW Mode) | |
| With Temperature | 0.005%/°C change in ambient temperature |
| With ±10% Line Voltage Variation | 0.005% |
| With Power Variation | 0.01% |
| Short Term | 100 KHz |
| Residual FM (CW Mode) | |
| at 2.0 GHz | ±10 KHz |
| at 12.0 GHz | ±35 KHz |
| at 18.0 GHz | ±20 KHz |
| RF Leveled Output Power (min) | 1 mW from 2.0 to 18.0 GHz (More power available over narrower sweep widths) |
| Residual AM (leveled) | 1% maximum |
| Spurious Signals | |
| Harmonic Related | 30 dB below fundamental |
| Non Harmonic Related | 40 dB below fundamental |
| Power Variation | |
| Leveled With Internal or External Leveling (using Model 3103 Directional Coupler) | ±1.5 dB ±0.75 typical max. (2.0 to 18.0 GHz) |
| Unleveled | 15 dB typical |
| Equivalent Source Match, Leveled | 1.5:1 maximum |
| Sweep Function | |
| START/STOP | |
| F1 to F2<br>F1 to M1<br>F1 to M2<br>M1 to M2<br>M1 to F2<br>M2 to F2 | Sweeps from 2.0 to 18.0 GHz or any part thereof; can sweep either up or down in frequency (sweeps at slow speed when sweeping down in frequency) |
| Range | All settings continuously and independtly adjustable over the entire frequency range |
| End-point Accuracy | 1% |

Table 1-1 (Cont)

| | |
|---|---|
| Sweep Function (Cont) | |
| ΔF Sweep | Symmetrical sweep centered on F1, M1, M2 or F2 |
| Width | 100 KHz to 100 MHz |
| Width Accuracy | Approximately 10% |
| Center Frequency Accuracy | 1% |
| Frequency Markers | M1 and M2 independently adjustable over entire frequency range. Amplitude and width adjustable from front panel controls. Auxiliary output available at rear panel. |
| Accuracy | 1% |
| Resolution | 200 KHz |
| Width | 8 MHz minimum |
| Marker Output | > -1 volt pulse into 100 K at rear panel |
| CW Mode | Single-frequency RF output selected by F1, M1, M2, or F2 pushbuttons depending on the tuner selected. |
| Accuracy | ±0.5% |
| Sweep Mode | |
| Internal | Sweep recurs automatically |
| Manual Scan | Front panel control provides continuous manual adjustment of selected sweep. |
| Line | Sweep is synchronized to line frequency |
| Triggered | |
| Single | Sweep is actuated by front panel pushbutton |
| External | +15 volt, 1 to 10μSec pulse width |
| Sweep Characteristics | |
| Sweep time | Continuously adjustable in four ranges, 0.01 to 100 seconds. Maximum allowable rate is any 1 GHz in 10 mSec. below 12 GHz. 12-18 GHz can be swept in 10 mSec. |

Table 1-1 (Cont)

| | |
|---|---|
| Sweep Characteristics (Cont) | |
| Sweep Indicator | Front panel indicator lights during the sweep to provide indication of sweep duration. |
| Sweep output | Direct coupled sawtooth, > 10 volts concurrent with RF output. 0 ±0.5 volts at beginning of sweep, > 10 volts at end of sweep regardless of sweep width or direction. Output impedance 20K. Available at front and rear panels. |
| Sweep Linearity | 1% |
| Reference Output | Direct coupled voltage equal to RF frequency (-2 to -18 volts = 2.0 to 18.0 GHz) |
| Blanking | RF is automatically turned off during retrace. RETRACE RF switch provided on front panel. |
| Blanking Output | Nominal +28 volt pulse provided at rear panel coincident with RF blanking, source impedance approximately 2,000Ω. |
| Pen Lift | Penlift terminals for X-Y recorder provided on rear panel. Terminals open during retrace. |
| Power Leveling Amplifier | Internal dc coupled leveling amplifier provided. |
| External Input | For negative output crystal detectors 3 mV to 5 mV. |
| Modulation | |
| Internal AM | Square wave modulation continuously adjustable from 800 to 1200 Hz. 30 dB on/off ratio. |
| External Pulsed AM | |
| Sensitivity | +15V to turn RF on |
| Bandwidth | 50 KHz approximately |
| On-off Ratio | 30 dB |

Table 1-1 (Cont)

| | |
|---|---|
| Modulation (Cont) | |
| External Frequency Control | |
| Sensitivity | +1V/GHz |
| Impedance | 13.85KΩ ±0.1% |
| Rate | 1 GHz/5mSec., Swept) Rear panel<br>5 Sec/Step, CW ) Selection |
| External Amplitude Control | |
| Frequency Response | dc-50 KHz leveled, approximately 30 dB range |
| Voltage | 0 to +2 volt |
| Impedance | 1,000Ω |
| External FM | |
| Rate | dc to 1 KHz |
| Deviation | Up to 2 MHz |
| Linearity | < 1% typical |
| Sensitivity | Approximately 1V/MHz into 10KΩ |
| Phase Lock FM (Option 2 only) | |
| FM | dc to 50 KHz (3 dB Bandwidth) |
| Deviation | Up to 10 MHz |
| Linearity | 0.1% Typical |
| Sensitivity | Approximately 50 KHz/MA into 100Ω on fundamental |
| RF Sample | |
| Frequency Range | 1.0 to 2.0 GHz and 12.4 to 18.0 GHz |
| Power | Between -5 and +5 dBm |
| Power Requirements | |
| AC Voltage | 115 or 230 VAC ±10%<br>50 to 400 Hz,<br>approximately 170<br>watts |

Table 1-1 (Cont)

| | |
|---|---|
| Physical Dimensions | |
| Height | 10 15/32 inches |
| Width | 16 3/4 inches |
| Depth | 16 1/4 inches |
| Weight | 57 pounds, net |
| Accessories Supplied | Line cord, rack adaptors, printed circuit board extension connector |

1-10. OPTIONS AVAILABLE

1-11. The following options may be ordered with the Model 9530 2.0 to 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR.

a. Option 1. Internal Leveling — Allows the Sweeper to automatically hold the RF amplitude constant as the frequency changes

b. Option 2. Phase Lock — Provides Phase Lock capability from 2.0 to 18.0 GHz.

1-12. OPTIONAL ACCESSORIES

1-13. Table 1-2 provides a listing of optional accessories available for use with the Model 9530 Sweeper.

Table 1-2

OPTIONAL ACCESSORIES

| | |
|---|---|
| Model 3103 | External Levelling Directional Detector |
| Model 3203 | Coaxial Directional Coupler |
| Model 3096 | Broadband High Directivity Coupler |
| Model 3305-2 | Broadband Power Divider (two way) |
| Model 3305-4 | Broadband Power Divider (four way) |
| Model 701 | 0-9 dB Step Attenuator |
| Model 703 (60) | 0-60 dB Step Attenuator (10 dB Steps) |

Table 1-2 (Cont)

| | |
|---|---|
| Model 703 (90) | 0-90 dB Step Attenuator (10 dB Steps) |
| Model 705 (69) | 0-69 dB Step Attenuator (1 dB Steps) |
| Model 705 (99) | 0-99 dB Step Attenuator (1 dB Steps) |
| Model 779 | Fixed Coaxial Attenuator |
| Model 9500-50 | Amplifier Adapter |

# SECTION II

# OPERATION

## 2-1. GENERAL.

2-2. The information contained in this section of the manual is the same for the Model 9530 Sweeper with the following addition to Paragraph 2-17 (Page 2-6) NOTE:

> The unit can sweep 6 GHz in 10 mS when sweeping from 12.0 to 18.0 GHz.
>
> When sweeping 6 GHz and the starting frequency is below 12.0 GHz rotate the SWEEP TIME VERNIER control to the 0.03 LIMIT position.

# SECTION III

# THEORY OF OPERATION

## 3-1. GENERAL

3-2. The information contained in this section of the manual is the same for the Model 9530 Sweeper with the following exceptions:

a. Change Paragraph 3-7 (Page 3-2) to read:

3-7 The Sweep Frequency Control Section generates a ramp voltage equal to the START/STOP frequency setting on the front panel F1 and F2 Digital Frequency Selectors (i.e., if F1 is set to 2.0 GHz and F2 is set to 18.0 GHz, the ramp generated would be 1.444 to 13.0 volts.) The 18/13 Amplifier is provided outputs between 2 and 18 volts. An override relay is provided to slow the sweep time by a factor of 10, if the TIME (SEC) Lever is in the .01-.1 position.

b. Change Paragraph 3-13 (Page 3-2) to read:

3-13 The RF and Leveling Section samples the ramp voltage, which is used to drive the L-Band oscillator. The output of the oscillator is fed through the L-Band Isolator and Amplifier stages to the multiplier. The KU Band Oscillator is driven by the KU Band Gunn Oscillator Driver, and is fed through the KU Band Isolator to the SPDT Switch. The 12 GHz comparator drives the channel selector switch circuit which activates the desired oscillator and in turn drives the PIN Diode Switch. The 12 GHz comparator also provides the cutoff voltage for the KU Band Gunn Oscillator.

c. The attached Simplified Block Diagram (Figures 3-2 and 3-10) supersedes Figures 3-2 (Page 3-3) and Figure 3-7 (Page 3-10) of this manual.

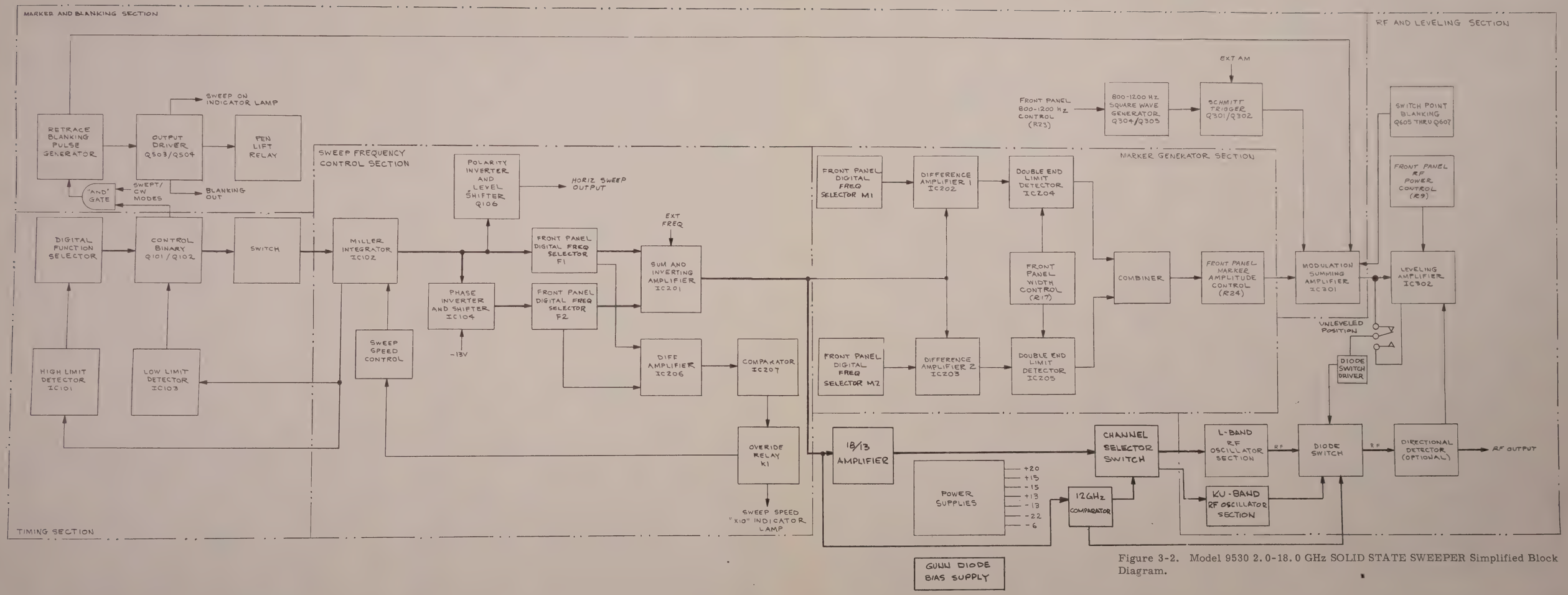



Figure 3-2. Model 9530 2.0-18.0 GHz SOLID STATE SWEEPER Simplified Block Diagram.

# SECTION IV

# MAINTENANCE

## 4-1. GENERAL.

4-2. The Maintenance Section of this manual has not been modified to reflect the additional Performance checks and alignment procedures required for the additional circuitry in the Model 9530.

# SECTION V

# PARTS LIST

## 5-1. GENERAL.

5-2. The Parts List has not been modified to reflect the components used only on the Model 9530 Sweeper.

# SECTION VI

# SCHEMATIC DIAGRAMS

## 6-1. GENERAL.

6-2. The attached schematic diagrams supersede the following figures appearing in Section VI of this manual. All other schematic diagrams (Figures 6-2, 6-3, 6-6 and 6-9) are applicable to the Model 9530 manual.

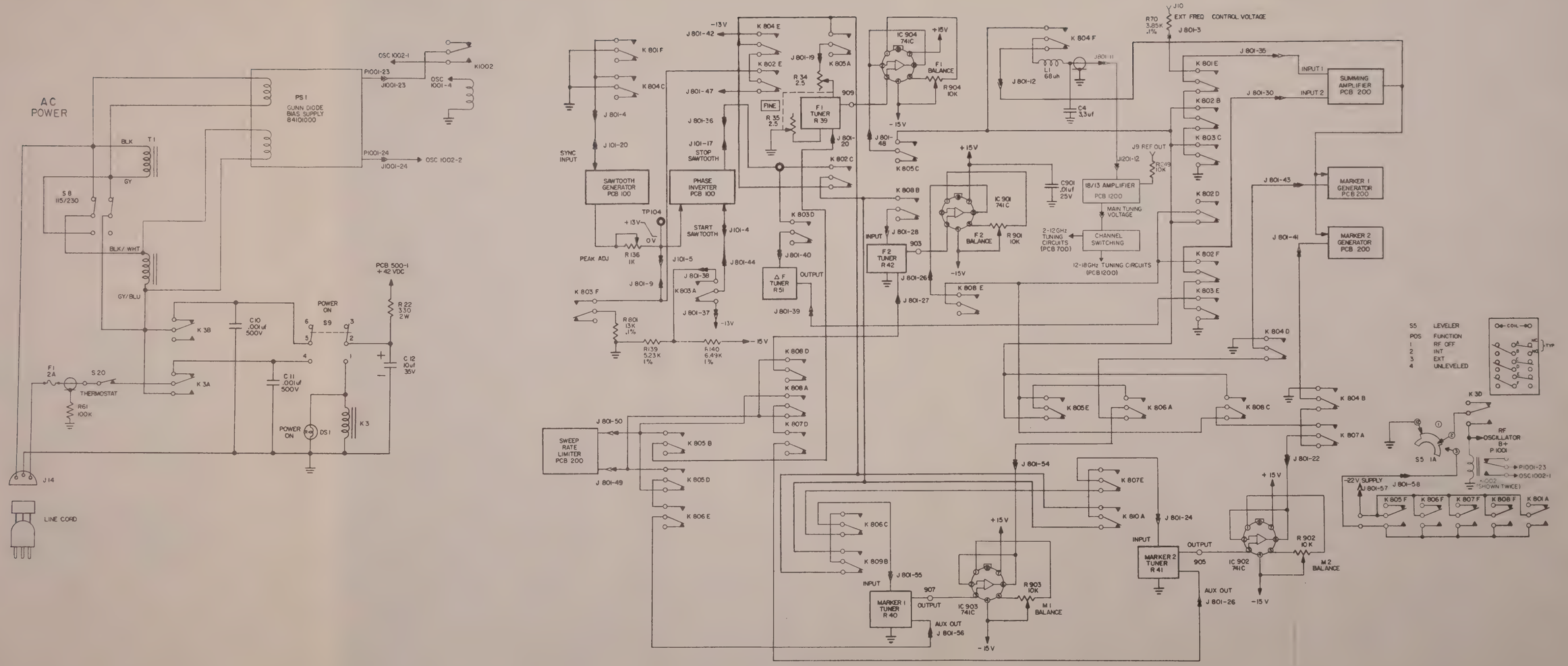



Figure 6-1. Model 9530, 2.0 - 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Functional Interconnection Drawing

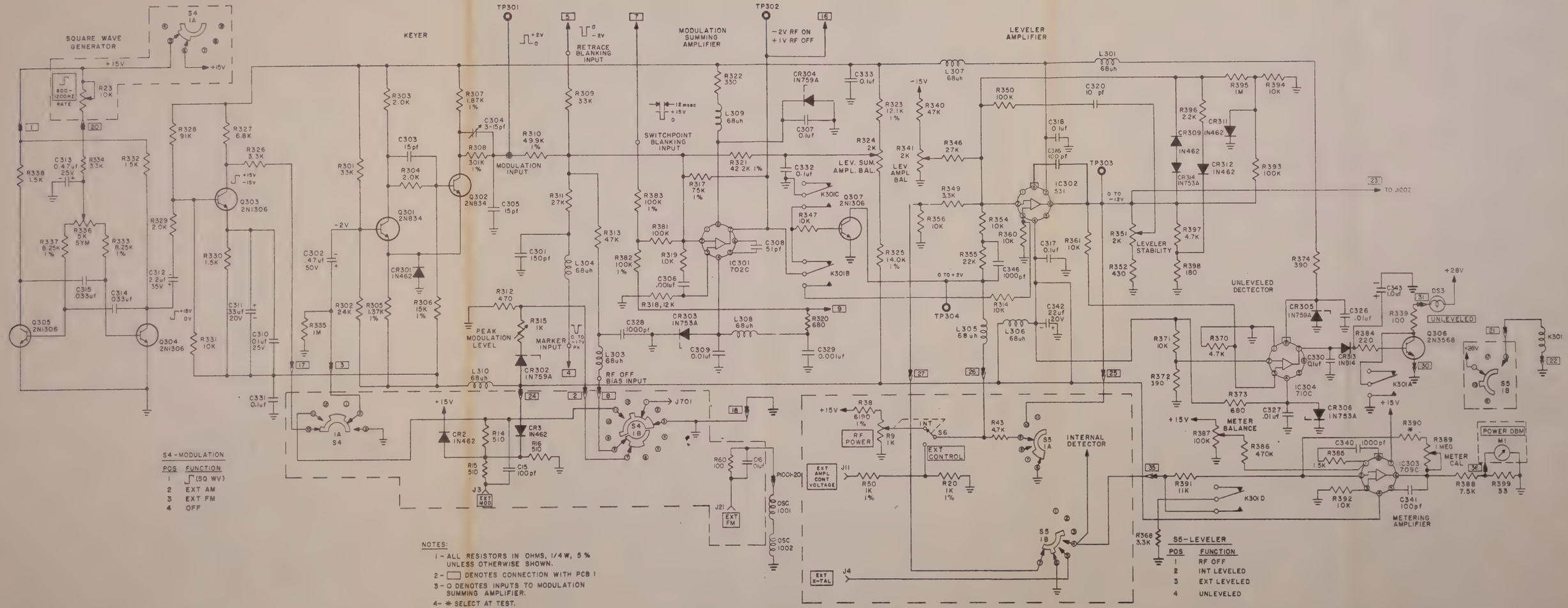
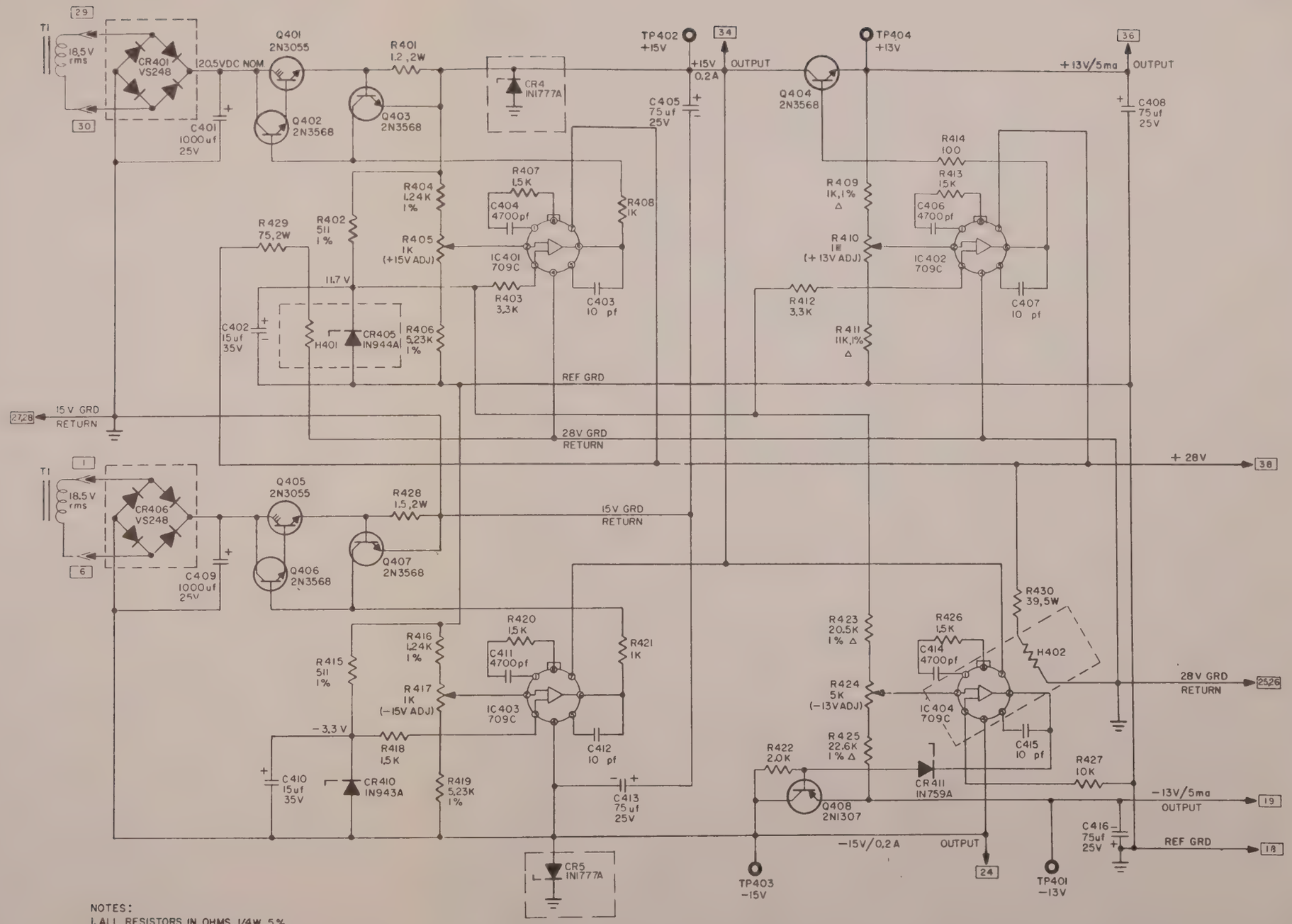



Figure 6-4. Model 9530, 2.0 - 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Printed Circuit Board Number 300 Schematic Diagram




NOTES:
1. ALL RESISTORS IN OHMS, 1/4W, 5% UNLESS OTHERWISE SHOWN
2. Δ MATCHED TC'S TO 3PPM/°C
3. ▭ DENOTES CONNECTION WITH PCB 1

Figure 6-5. Model 9530, 2.0 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Printed Circuit Board Number 400 Schematic Diagram

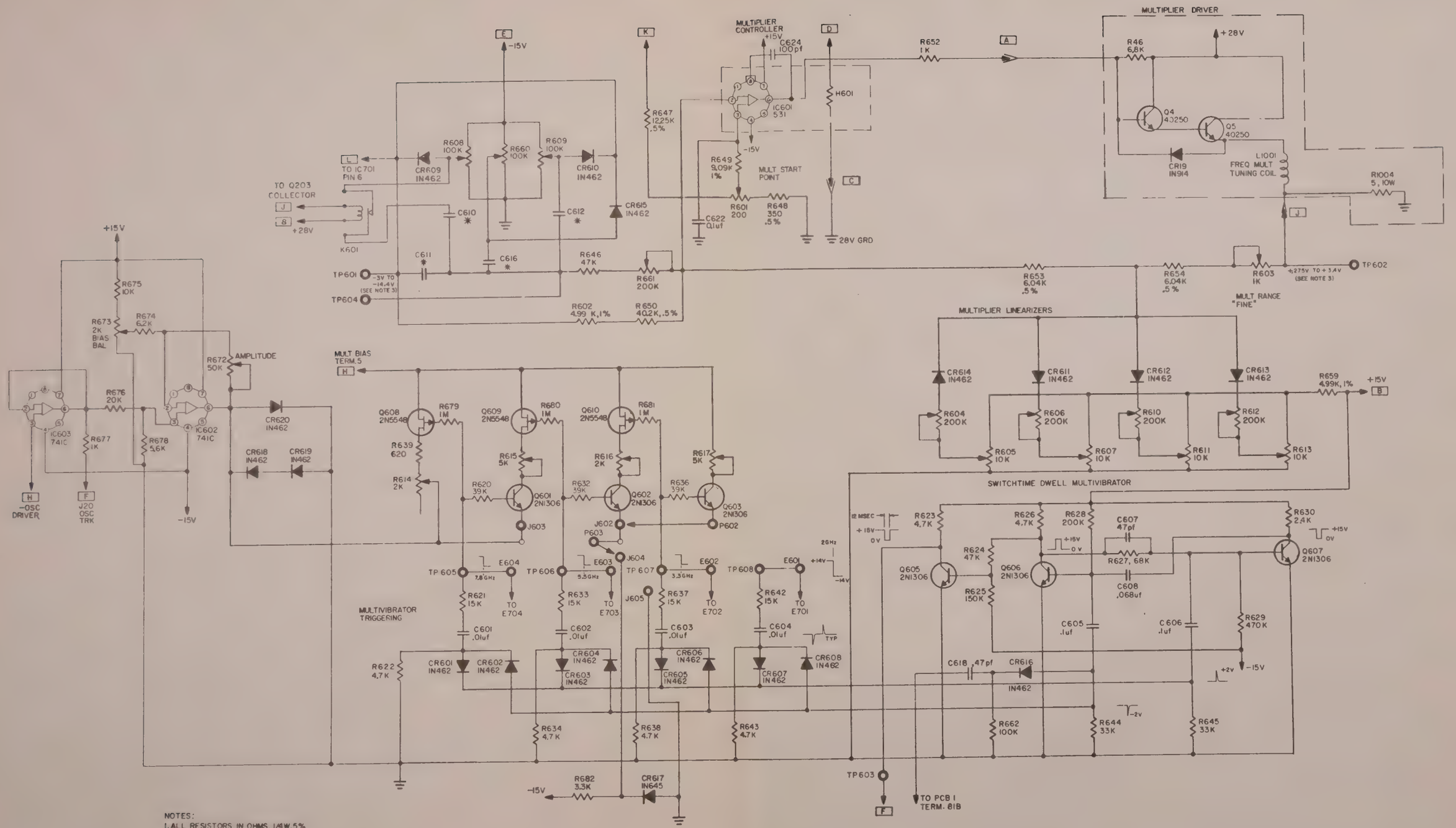



Figure 6-7. Model 9530, 2.0 - 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Printed Circuit Board Number 600 Schematic Diagram

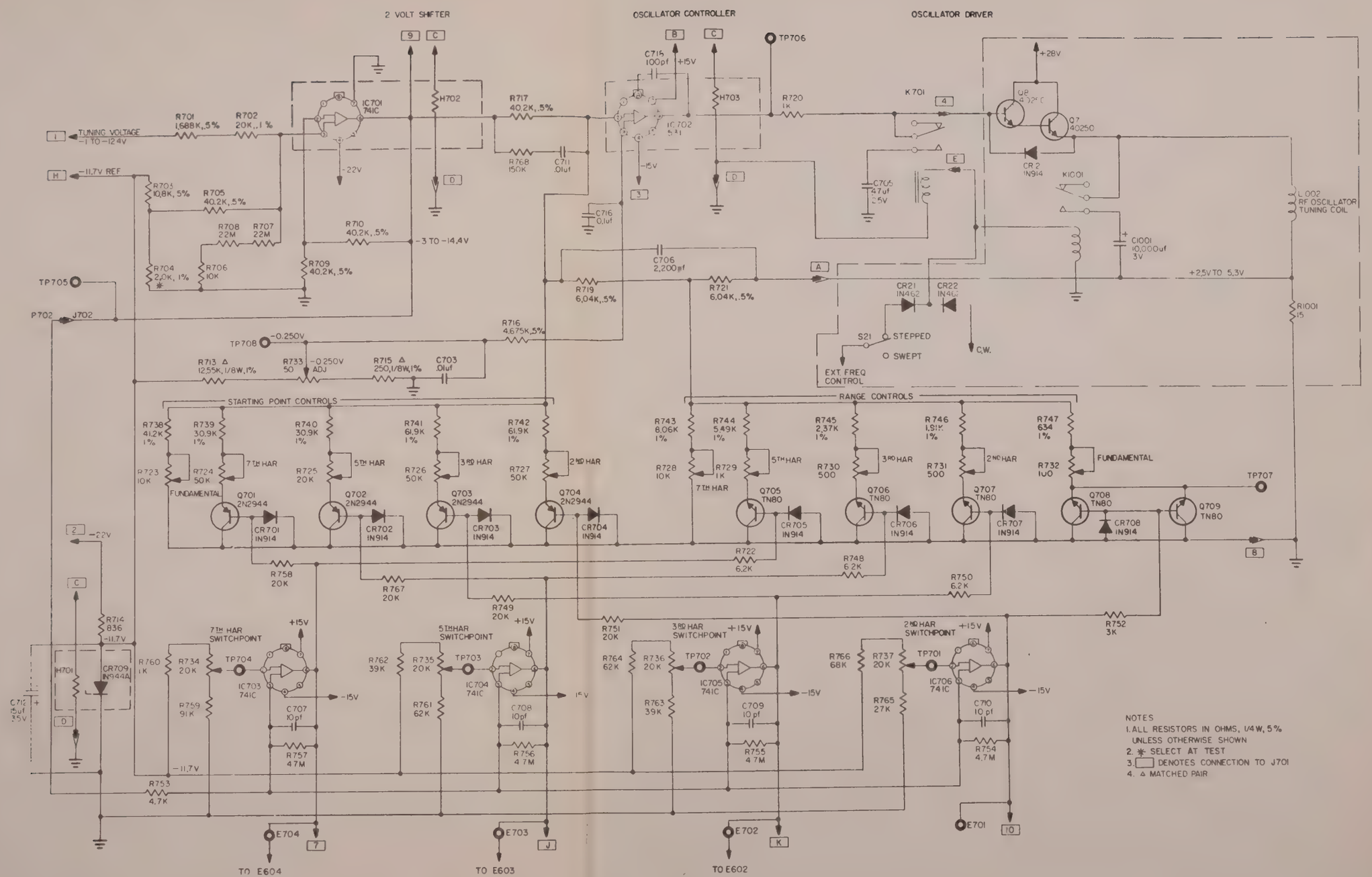



Figure 6-8. Model 9530, 2.0 - 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Printed Circuit Board Number 700 Schematic Diagram

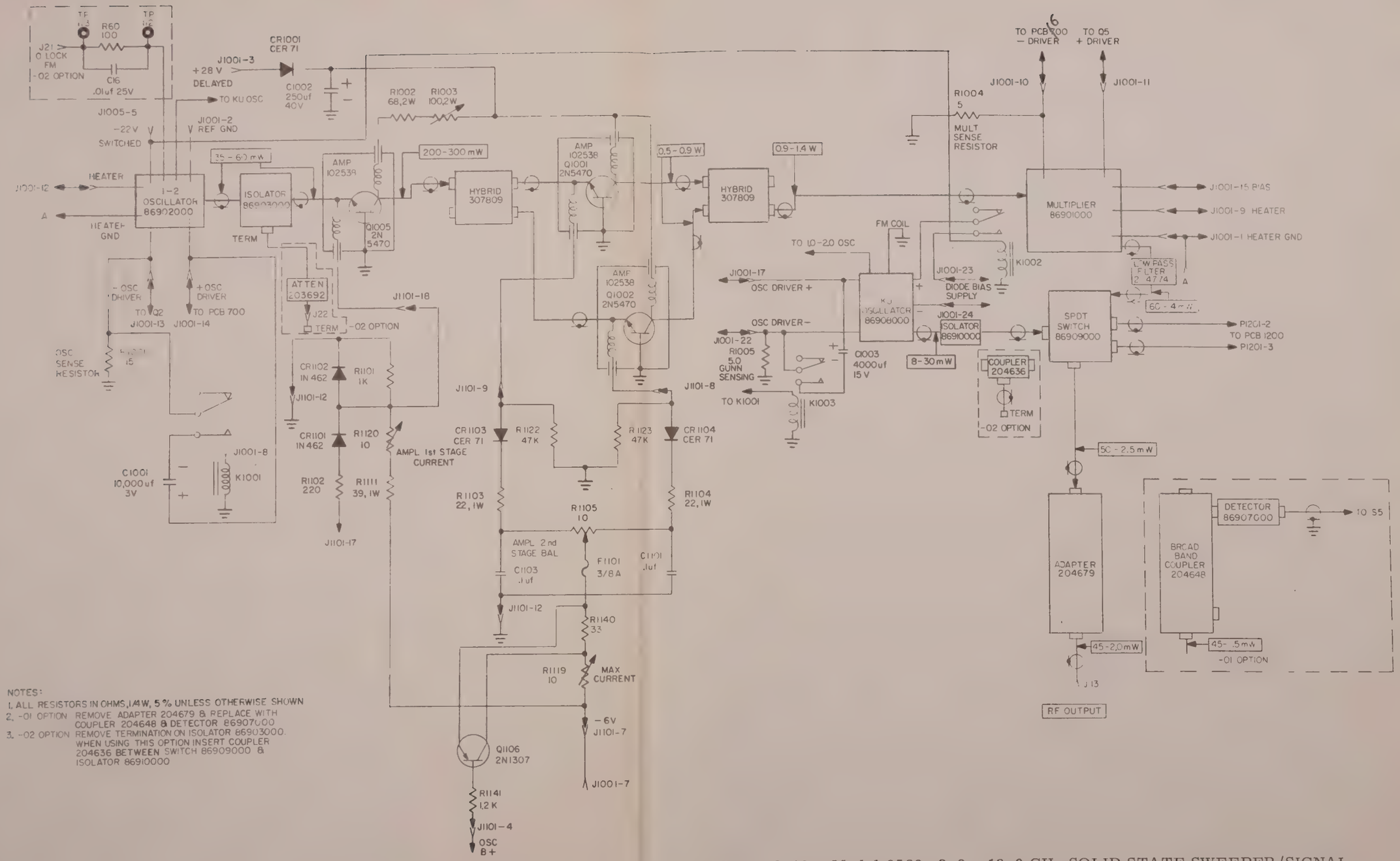
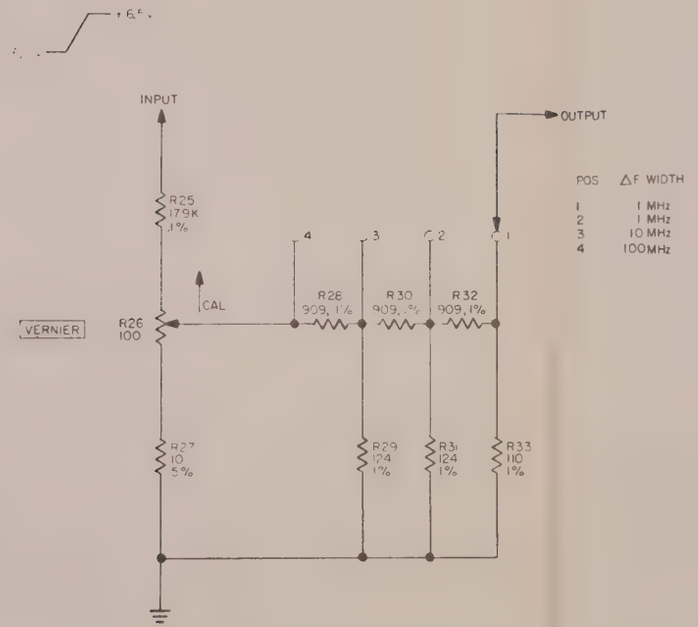
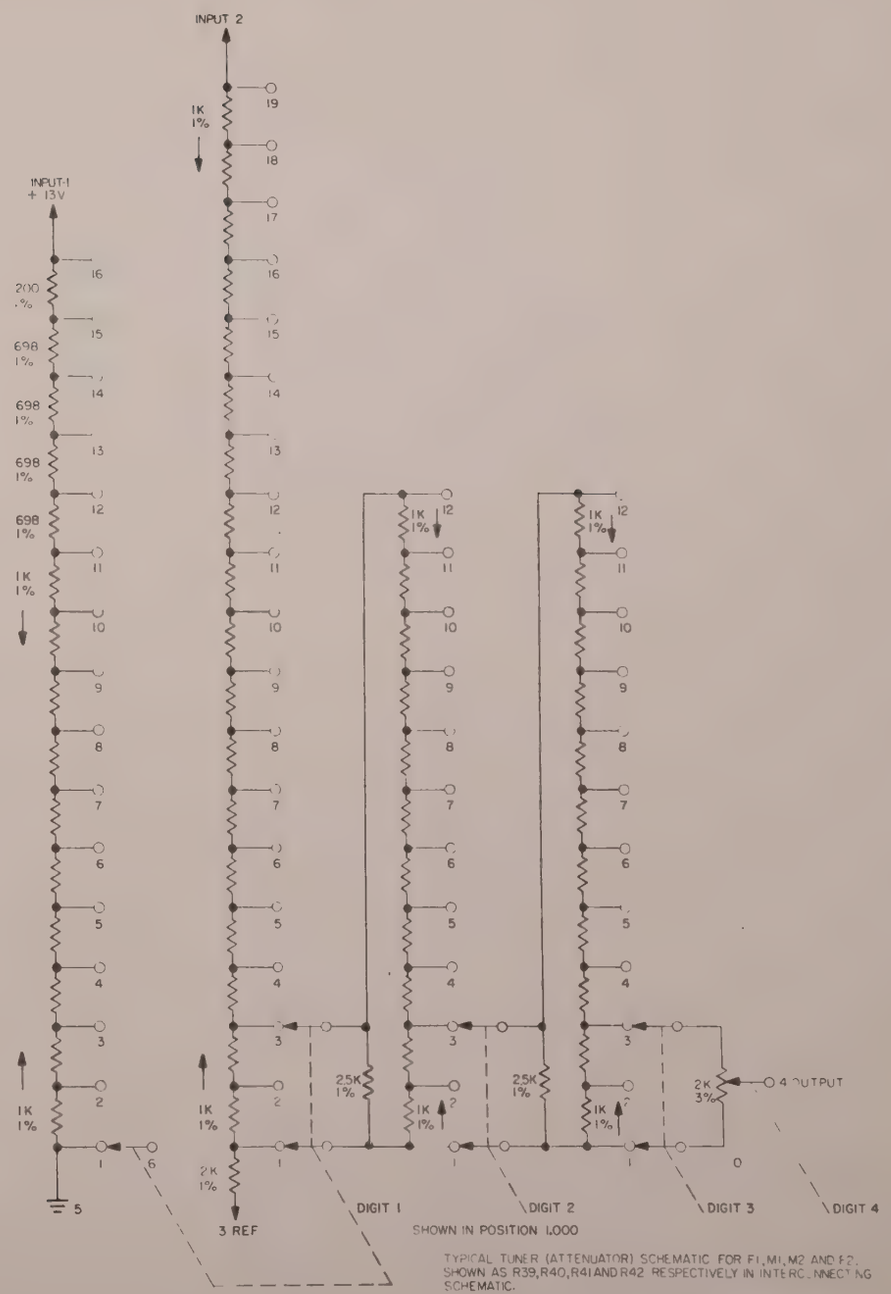



Figure 6-10. Model 9530, 2.0 - 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR RF Section Schematic Diagram




ΔF TUNER (ATTENUATOR)
SHOWN AS R51 IN INTERCONNECTING SCHEMATIC




TYPICAL TUNER (ATTENUATOR) SCHEMATIC FOR F1, M1, M2 AND F2. SHOWN AS R39, R40, R41 AND R42 RESPECTIVELY IN INTERCONNECTING SCHEMATIC.

Figure 6-11. Model 9530, 2.0 - 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Digital Display Counter Schematic Diagram

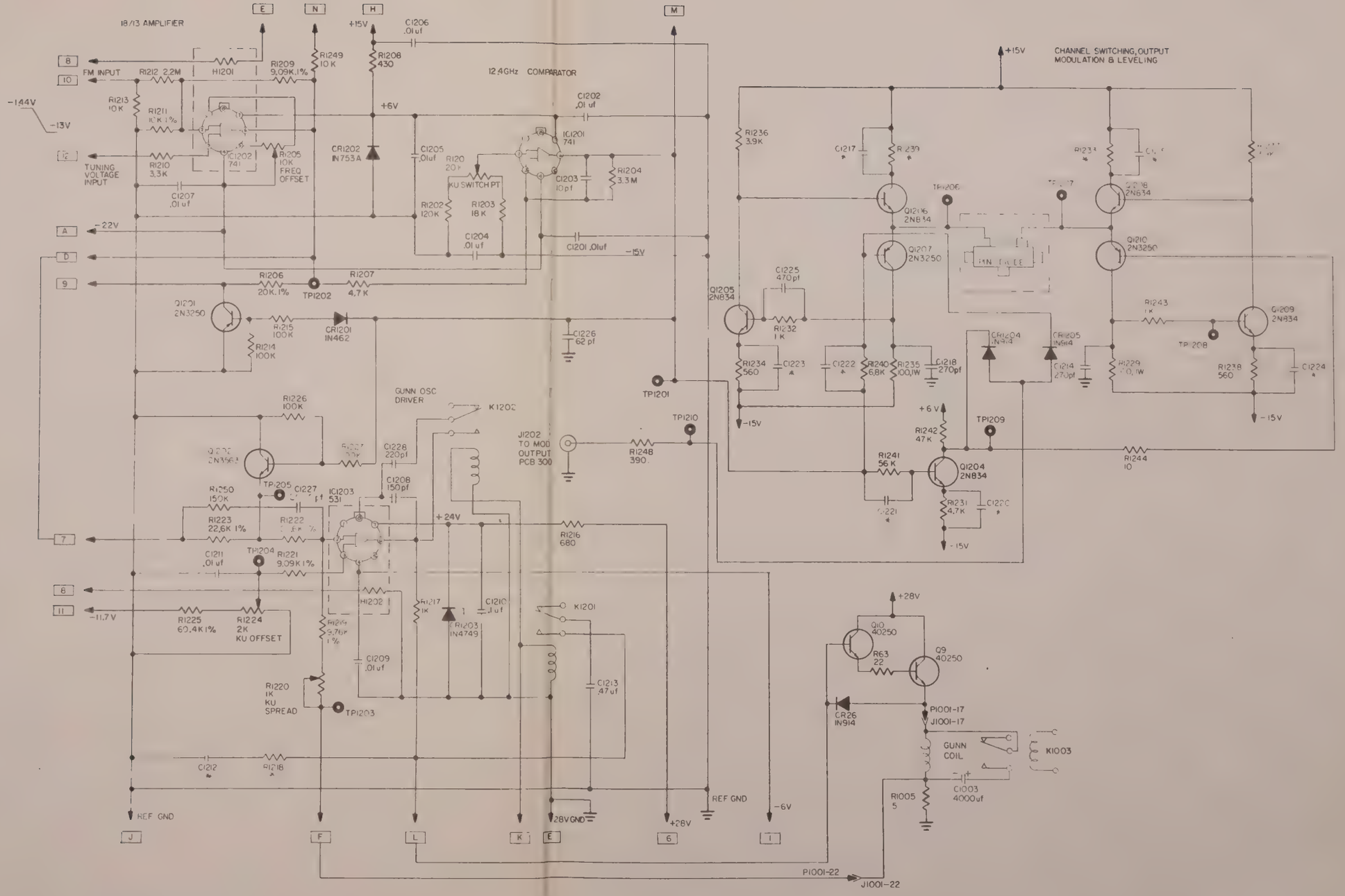
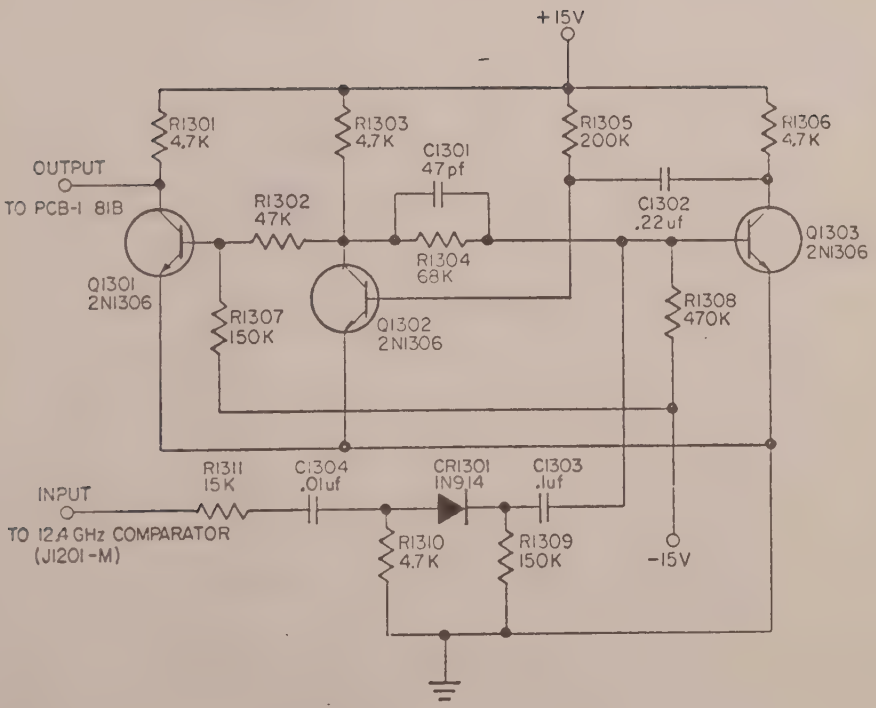



Figure 6-12. Model 9530, 2.0 - 18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Printed Circuit Board Number 1200 Schematic Diagram




NOTES:
1. ALL RESISTORS IN OHMS, 1/4 W, 5%
2. R1301 IS REMOVED AFTER TEST

Figure 6-13. Model 9530, 2.0-18.0 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Printed Circuit Board Number 1300 Schematic Diagram

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# SECTION I

# GENERAL DESCRIPTION

## 1-1. INTRODUCTION.

1-2. This manual contains complete instructions for the operation and maintenance of the Narda Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR designed and manufactured by The Narda Microwave Corporation, Plainview, New York 11803. This manual includes a general description of the equipment, operating instructions, theory of operation, maintenance procedures and replaceable parts list.

## 1-3. DESCRIPTION. (See figure 1-1.)

1-4. The Narda Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR is a unique and versatile unit designed to provide a single unit which can sweep from 1.0 to 12.4 GHz or any smaller portion continuously and remain leveled. It can be programmed for amplitude of signal and frequency in laboratory testing for system flexibility. The programmable frequency input is directly correlated in one volt per GHz, allowing a DVM to read frequency directly. The programmable rf power capability provides a 30dB

Figure 1-1. Narda Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/ SIGNAL GENERATOR.

dynamic range for a zero to plus two volt input. The signal frequency and power level can be programmed from an analog source.

1-5. SPECIFICATIONS.

1-6. Table 1-1 lists the specifications for the Model 9500/9510 SOLID STATE SWEEPER/SIGNAL GENERATOR.

NOTE

Model 9510 specifications, except frequency range, are the same as for the Model 9500.

Table 1-1

Specifications

| | |
|---|---|
| **Frequency** | |
| Range 9500 | 1.0 to 12.4 GHz |
| 9510 | 2.0 to 12.4 GHz |
| Resolution | 200 KHz normal<br>50 KHz on FINE control for F1 Digital Display Counter |
| Stability (CW mode) | |
| With Temperature | 0.005%/° C change in ambient temperature |
| With ±10% Line Voltage Variation | 0.005% |
| With Power Variation | 0.005% (2.0 to 12.4 GHz)<br>0.01% (1.0 to 2.0 GHz) |
| Short Term | 50 KHz |
| Residual FM (CW mode) | |
| at 1.0 GHz | ±5 KHz |
| at 12.4 GHz | ±50 KHz |
| RF Leveled Output Power (Min) | 1 mW from 1.0 to 12.4 GHz<br>(More power available over narrower sweep widths) |
| Residual AM | 1% |
| Spurious Signals | |
| Harmonic Related | 20dB below fundamental below 2 GHz<br>30dB below fundamental above 2 GHz |
| Non-Harmonic Related | 40db below fundamental |

Table 1-1 (Cont)

| | |
|---|---|
| Power Variation<br>Leveled<br>With Internal or External<br>Leveling (using Model 3102<br>Directional Coupler) | ±1.0dB from 1.0 to 12.4 GHz |
| Unleveled | 15dB typical |
| Equivalent Source Match, Leveled | 1.5:1 maximum |
| Sweep Function<br>START/STOP | |
| F1 to F2<br>F1 to M1<br>F1 to M2<br>M1 to M2<br>M1 to F2<br>M2 to F2 | Sweeps from 1.0 to 12.4 GHz or any part thereof; can sweep either up or down in frequency (sweeps at slow speed when sweeping down in frequency) |
| Range | All settings continuously and independently adjustable over the entire frequency range |
| End-point Accuracy | 1% or 20 MHz |
| Δ F Sweep | Symmetrical sweep centered on F1, M1, M2 or F2 |
| Width | 100 KHz to 100 MHz |
| Width Accuracy | Approximately 10% |
| Center Frequency Accuracy | 1% |
| Frequency Markers | M1 and M2 independently adjustable over entire frequency range. Amplitude and width adjustable from front panel controls. Auxiliary output available at rear panel |
| Accuracy | 1% |
| Resolution | 200 KHz |
| Width | 8 MHz minimum |
| Marker Output | >1 volt pulse into 100 K at rear panel |
| CW Mode | Single-frequency RF output selected by F1, M1, M2 or F2 pushbuttons depending on the tuner selected |
| Accuracy | 0.5% |

Table 1-1 (Cont)

| | |
|---|---|
| Sweep Mode | |
| Internal | Sweep recurs automatically |
| Manual Scan | Front panel control provides continuous manual adjustment of selected sweep |
| Line | Sweep is synchronized to line frequency |
| Triggered | |
| Single | Sweep is actuated by front panel pushbutton |
| External | +15 Volt, 1 to 10μSec pulse width |
| Sweep Characteristics | |
| Sweep time | Continuously adjustable in four ranges, 0.01 to 100 seconds. Maximum allowable rate is any 1 GHz in 10mSec. |
| Sweep Indicator | Front panel indicator lights during the sweep to provide indication of sweep duration |
| Sweep Output | Direct coupled sawtooth, ±0.5 to >+10 volts concurrent with RF output. 0.5 volts at beginning of sweep, 10 volts at end of sweep regardless of sweep width or direction. Output impedance 20K. Available at front and rear panels. |
| Sweep Linearity | 1% |
| Reference Output | Direct coupled voltage equal to RF frequency (1.0 to 12.4 volts = 1.0 to 12.4 GHz) |
| Blanking | RF is automatically turned off during retrace. RETRACE RF switch provided on front panel. |
| Blanking Output | Nominal +28 volt pulse provided at rear panel coincident with RF blanking, source impedance approximately 2,000Ω. |
| Pen Lift | Pen lift terminals for X-Y recorder provided on rear panel. Terminals open during retrace. |
| Power Leveling Amplifier | Internal dc coupled leveling amplifier provided. |
| External Input | For negative output crystal detectors 3mV to 50mV. Narda Model 3102 Directional Detector has a sensitivity of 0.01mV/μW. |

Table 1-1 (Cont)

| | |
|---|---|
| Modulation | |
| Internal AM | Square wave modulation continuously adjustable from 800 to 1200 Hz. 30dB on/off ratio. |
| External Pulsed AM | |
| Sensitivity | +15V to turn RF on |
| Bandwidth | 50 KHz approximately |
| On-off Ratio | 30dB |
| External Frequency Control | |
| Sensitivity | +1V/GHz |
| Impedance | 10KΩ±0.1% |
| Rate | 1 GHz/5mSec., swept; 5 Sec./step CW (Selectable at rear panel.) |
| External Amplitude Control | |
| Frequency Response | dc to 50 KHz leveled and unleveled approximately 30dB range |
| Voltage | 0 to +2 volts |
| Impedance | 1KΩ |
| External FM | |
| Rate | dc to 1 KHz |
| Deviation | Up to 2 MHz |
| Linearity | <1% typical |
| Sensitivity | Approximately 1V/MHz into 100Ω |
| Phase Lock FM (option 2 only) | |
| Rate | dc to 50 KHz (3dB Bandwidth) |
| Deviation | Up to 2 MHz (1.0 to 2.0 GHz)<br>14 MHz (8.0 to 12.4 GHz) |
| Linearity | 0.1% typical |
| Sensitivity | Approximately 50 KHz/MA into 100Ω on fundamental |
| RF Sample | |
| Frequency Range | 1.0 to 2.0 GHz |
| Power | Between -5 and +5 dBm |

Table 1-1 (Cont)

| | |
|---|---|
| Power Requirements | |
| AC voltage | 115 or 230 vac ±10%<br>50 to 400 Hz, approximately 150 watts |
| Physical Dimensions | |
| Height | 8 3/4 inches |
| Width | 16 3/4 inches |
| Depth | 15 1/4 inches |
| Weight | 47 pounds, net |
| Accessories Supplied | Line cord, rack adaptors, Printed circuit board extension connector |

1-7. OPTIONS AVAILABLE.

1-8. The following options may be ordered with the Model 9500 1.0 to 12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR by specifying the option number.

a. Option 1. Internal Leveling — Allows the sweeper to automatically hold the RF amplitude constant as the frequency changes.

b. Option 2. Phase Lock — Provides sampling of sweeper fundamental oscillator (1.0 to 2.0 GHz); BNC terminal for fine tuning of the Sweep oscillator.

1-9. OPTIONAL ACCESSORIES.

1-10. Table 1-2 provides a listing of optional accessories available for use with the Model 9500 Sweeper.

Table 1-2

Optional Accessories

| | |
|---|---|
| Model 3102 | External Leveling Directional Detector |
| Model 3202B | Coaxial Directional Coupler |
| Model 3293 | 1.0 to 12.4 GHz Broadband High Directivity Coupler |
| Model 5293 | 1.0 to 12.4 GHz Broadband High Directivity Coupler |
| Model 700 | 0 - 9dB Step Attenuator (1dB Steps) |

Table 1-2 (Cont)

| | |
|---|---|
| Model 702 (60) | 0 - 60dB Step Attenuator (10dB Steps) |
| Model 702 (90) | 0 - 90dB Step Attenuator (10dB Steps) |
| Model 704 (69) | 0 - 69dB Step Attenuator (1dB Steps) |
| Model 704 (99) | 0 - 99dB Step Attenuator (ldB Steps) |
| Models 757C and 777C | Fixed Coaxial Attenuators |
| Model 9500-50 | Amplifier Adapter insures compatability of synchronizing and marker voltages with HP model 8410 Network Analyzer. |

1-11. UNPACKING AND RESHIPMENT.

1-12. UNPACKING.

1-13. Upon receipt of the Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR, unpacking should be performed with general precaution. The unit is packaged in a double cardboard carton and is lined with foam filler material for protection during shipping. Prior to opening the carton, a visual inspection of the exterior of the carton should be performed in order to determine whether any damage has occured in transit. If damage does exist, the shipping agent should be immediately notified before opening the carton.

1-14. If there is no evidence of damage, unpack the unit, following conventional procedures and care.

NOTE

Retain the shipping container and packing material for protection of unit during reshipping.

1-15. RESHIPMENT.

1-16. When reshipping unit the original packing material and shipping container should be used. If the original material is not available, a high density filler material approximately four inches thick and double high burst cardboard carton should be used.

1-17. The following procedure should be followed when packing the unit for reshipment.

a. Cover the bottom of the carton with a single layer of filler material.
b. Place unit into the carton with the handles up.
c. Place filler material on all four sides of unit.
d. Place filler material on top of unit, ensure that sufficient material is placed between the handles to brace them against damage.
e. Seal carton in the conventional manner.

# SECTION II

# OPERATION

## 2-1. GENERAL.

2-2. This section provides the complete functional control description and operating instructions for the Narda Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR.

## 2-3. PRELIMINARY INSPECTION.

2-4. This unit was tested and inspected at the factory before shipment. Immediately after unpacking the equipment visually inspect it for damage which may have occurred in transit, such as broken knobs, damaged meters, etc. If there is any evidence of damage, immediately file claim for damage in transit with the carrier.

## 2-5. CONTROL PANEL DESCRIPTION (See figures 2-1 and 2-2)

2-6. FRONT PANEL. Table 2-1 provides a complete functional description of all front panel controls and indicators.

2-7. REAR PANEL. Table 2-2 provides a complete functional description of all rear panel controls and connectors.

## 2-8. BASIC OPERATING PRINCIPLES.

## 2-9. SWEEP FUNCTIONS.

2-10. The Sweeper has four sweep functions which are designated EXT FREQ CONT, START/STOP, $\Delta$F and CW. Four separate pushbuttons, each labeled for the function it selects, determine the mode of operation.

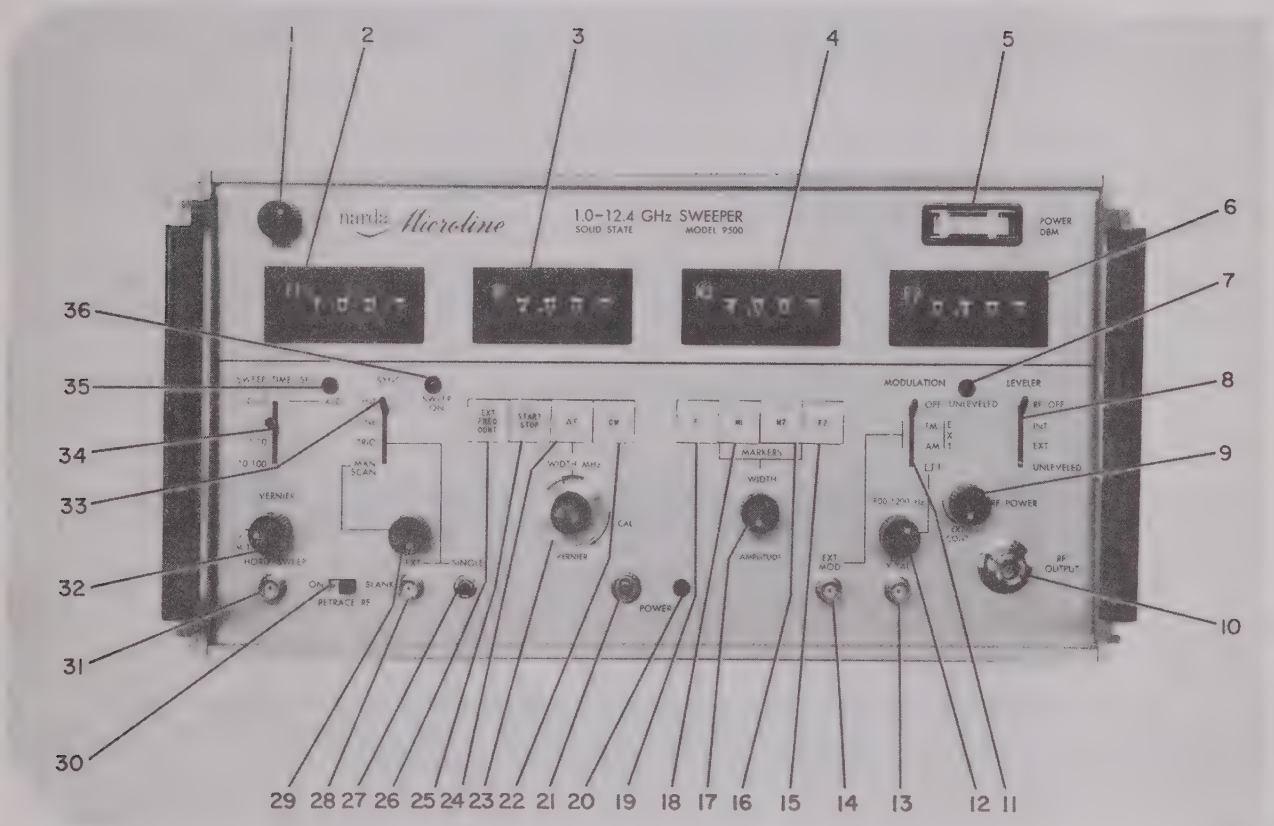
## 2-11. EXT FREQ CONT.

2-12. The EXT FREQ CONT function provides a means of controlling the output frequency which varies in direct proportion with the externally controlled input voltages applied to the rear panel EXT CONTROL VOLTAGE FREQ. Connector.

2-13. During EXT FREQ CONT operation the remaining frequency selector pushbutton switches and the SWEEP TIME Lever are inoperative. Refer to paragraph 2-27 for proper EXT FREQ CONT operation.

## 2-14. START/STOP.

2-15. The sweep START and STOP frequencies are separately set on the Digital Frequency Selectors F1 and F2 respectively to any frequency from 1.0 to 12.4 GHz. Selected marker frequencies can be set on Digital Frequency Selectors M1 and M2. When both marker frequencies are not required M1, M2 or both M1 and M2 may be used for the START




*If unit does not contain Option 01; POWER DBM Meter will not respond, when the LEVELER Lever (8) is in the INT Position.

The POWER DBM Meter will respond when unit is externally leveled and the LEVELER Lever is in the EXT Position.

Figure 2-1. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Front Panel Controls and Indicators.

Table 2-1

Front Panel Control and Indicator Functional Description

| Figure 2-1 Index No. | Control | Function |
|---|---|---|
| 1. | FINE Control | Provides 50 KHz of resolution for F1 when in the CW mode. |
| 2. | F1 Digital Frequency Selector | Digital counter sets and displays START frequency when operating in the START/STOP mode, or one of the center frequencies in the Δ F mode, or the operating frequency when in the CW mode. |
| 3. | M1 Digital Frequency Selector | Digital counter sets and displays one of the marker frequencies or either the START or STOP frequency when operating in the START/STOP mode, or one of the center or marker frequencies in the Δ F mode, or the operating frequency when in the CW mode. |
| 4. | M2 Digital Frequency Selector | Same as M1 Digital Frequency Selector. |
| 5. | POWER DBM Meter | Indicates calibrated power output. (For units containing Option 01, or units externally leveled with LEVELER Lever (8) in EXT position.) |
| 6. | F2 Digital Frequency Selector | Same as F1 Digital Frequency Selector; displays STOP frequency instead of START frequency. |
| 7. | UNLEVELED Indicator Light | Indicates power leveling across selected frequency range (lights when unleveled). |
| 8. | LEVELER Lever | Provides means of selecting the desired leveled or unleveled mode or removing the RF signal when in the RF OFF position. |
| 9. | RF POWER Control | Provides means of adjusting the RF amplitude or switching to an external control amplitude signal. |
| 10. | RF OUTPUT Connector | Provides RF output into 50 ohms. |
| 11. | MODULATION LEVER | Provides means of selecting the desired modulation. |
| 12. | 800-1200 Hz Control | Provides means of varying the frequency of the internal Square Wave generator from 800-1200 Hz. |

Table 2-1 (Cont)

| Figure 2-1 Index No. | Control | Function |
|---|---|---|
| 13. | EXT X-TAL Connector | Provides means of accepting leveling signal from external crystal detector. |
| 14. | EXT MOD Connector | Provides means of accepting external modulation signal. |
| 15. | F2 Pushbutton Switch | When used, selects the STOP frequency when operating in the START/STOP mode, or can select one of the center frequencies in the Δ F mode, or the operating frequency when in the CW mode. The selected frequency is indicated on the F2 Digital Frequency Selector. |
| 16. | M2 MARKERS Pushbutton Switch | Selects one of the marker frequencies, or either the START or STOP frequencies in the START/STOP mode, or one of the center frequencies in the Δ F mode, or the operating frequency when in the CW mode. The selected frequency is indicated on the M2 Digital Frequency Selector. |
| 17. | MARKER WIDTH-AMPLITUDE Control | Provides means of varying the width (black knob) and the amplitude (red knob) of the frequency markers. |
| 18. | M1 MARKERS Pushbutton Switch | Same as M2 MARKERS Pushbutton Switch. The selected frequency is indicated on the M1 Digital Frequency Selector. |
| 19. | F1 Pushbutton Switch | When used, selects START frequency, functions same as F1 Pushbutton Switch. The START frequency is indicated on the F1 Digital Frequency Selector. |
| 20. | Power Indicator Lamp | Indicator lamp lights when Sweeper is operating. |
| 21. | POWER Switch | Applies primary power to Sweeper. |
| 22. | CW Pushbutton Switch | Selects CW mode of operation. |
| 23. | WIDTH MHz-VERNIER Control | (Black knob) provides means of selecting desired sweep width between .1-100 MHz. (Red knob) varies bandwidth within selected range. The full clockwise position of this knob provides maximum sweep width in each position of the black knob. |

Table 2-1 (Cont)

| Figure 2-1 Index No. | Control | Function |
|---|---|---|
| 24. | ΔF Pushbutton Switch | Selects ΔF mode of operation. |
| 25. | START/STOP Pushbutton Switch | Selects the Start and Stop sweep mode operation. |
| 26. | EXT FREQ CONT Pushbutton Switch | Permits application of the external programmable frequency by means of analog voltage through rear panel connector, and removes the internal frequency control. |
| 27. | SINGLE Triggered Sweep Pushbutton Switch | Provides means of actuating single sweep when SYNC lever (Index No. 33) is in the TRIG position. |
| 28. | EXT Triggered Sweep Connector | Provides means of applying external triggering signal, when SYNC lever (Index No. 33) is in the TRIG position. |
| 29. | MAN SCAN Control | Provides means of manually scanning sweep signal, when SYNC lever (Index No. 33) is in MAN SCAN position.<br>NOTE<br>This control permits manual scanning of the complete selected sweep range that would be swept when the SYNC lever (Index No. 33) is in the INT position. |
| 30. | RETRACE RF Slide Switch | Provides means of automatically blanking the RF signal during retrace.<br>NOTE<br>When the RETRACE RF Slide Switch is in the ON position, the RF signal will blank during part of the retrace time, when the Sweeper is operated at its fastest sweep speeds. However, when the Sweeper is operated at recorder speeds (typically 10 seconds) with the RETRACE RF Slide Switch in the ON position the RF signal will not blank during the retrace time. When the RETRACE RF Slide Switch is in the BLANK position the signal will blank during retrace at any sweep speed. |

Table 2-1 (Cont)

| Figure 2-1 Index No. | Control | Function |
|---|---|---|
| 31. | HORIZ SWEEP Connector | Provides horizontal sweep output for display. |
| 32. | VERNIER Control | Varies sweep time within selected range. |
| 33. | SYNC Lever | Provides means of selecting the following sweep modes:<br>a. INT position - the sweep automatically recurs.<br>b. LINE position - the sweep is synchronized with the line frequency.<br>c. TRIG position - the sweep is actuated by the SINGLE pushbutton switch (Index No. 27) or EXT Trigger Sweep Connector (Index No. 28).<br>d. MAN SCAN position - the MAN SCAN Control (Index No. 29) provides continuous manual sweep of the selected range. |
| 34. | SWEEP TIME (SEC) Lever | Provides means of selecting range of sweep time from .01 to 100 seconds. |
| 35. | SWEEP TIME (SEC) X10 Indicator Lamp | Indicator lamp lights when unit automatically increases the sweep time by ten when sweeping wide frequency range. |
| 36. | SWEEP ON Indicator Lamp | Indicator lamp lights during sweep. |

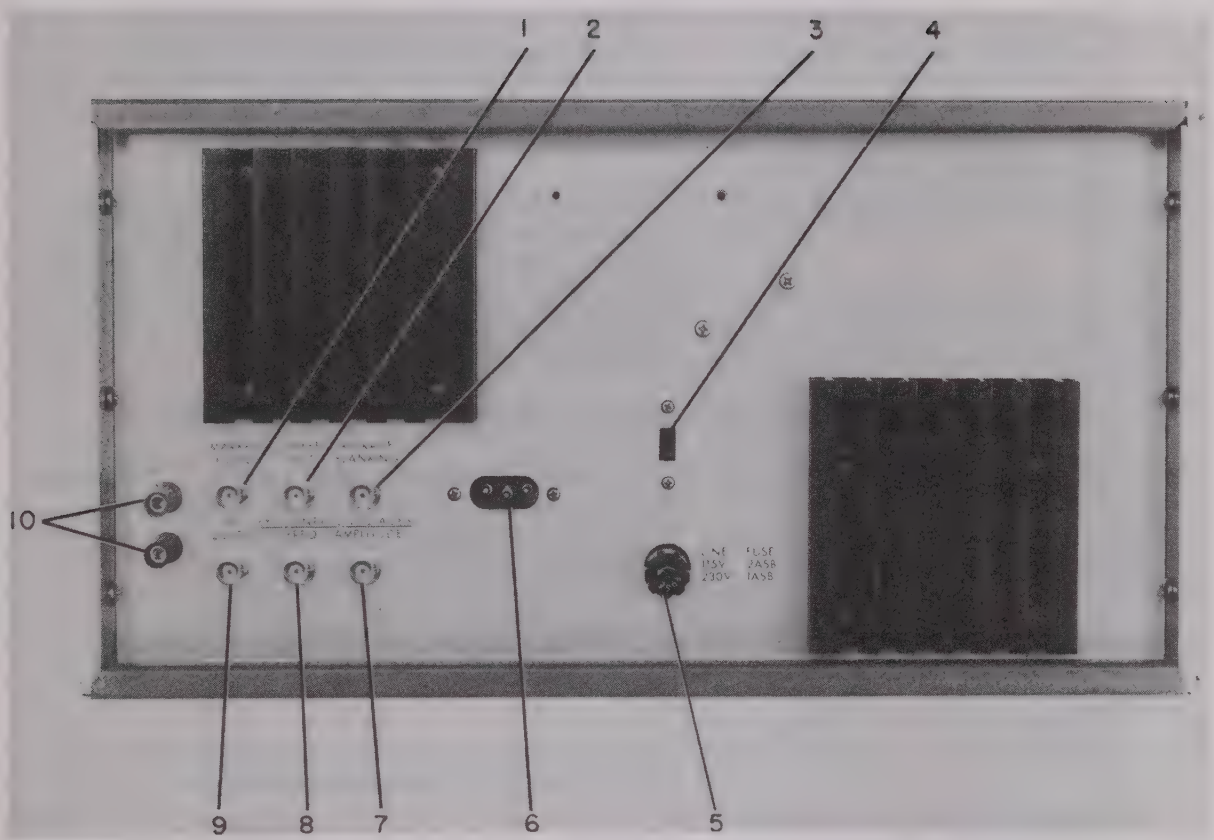



Figure 2-2. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/ SIGNAL GENERATOR Rear Panel Controls and Indicators.

Table 2-2

Rear Panel Control and Connector Functional Description

| Figure 2-2 Index No. | Control | Function |
|---|---|---|
| 1. | MARKER PULSE Connector | Provides auxiliary marker pulse (>1V) peak output. |
| 2. | SWEEP OUT Connector | Provides horizontal sweep output for display. (Identical to HORIZ SWEEP connector (Figure 2-1, No. 31)) |
| 3. | RETRACE BLANKING | Provides a nominal +28 volt pulse coincident with RF blanking. |
| 4. | LINE FUSE | Provides receptacle for line voltage fuse. |
| 5. | 115V/230V Slide Switch | Provides for selection of either 115V/230V AC line voltage. |
| 6. | RF SAMPLE Connector | Provides a portion of the fundamental (1.0 to 2.0 GHz) RF power output. (Option 2) |
| 7. | 115V/230V Receptacle | Provides for connection to 115V/230V AC power. |
| 8. | Ø LOCK FM Connector | Provides means of injecting phase locking (correction) voltages. (Option 2) |
| 9. | OSC TRK Connector | Provides means of synchronizing the Sweeper Oscillator frequency with the Oscillator frequency of available Network Analyzers. |
| 10. | EXT CONTROL VOLTAGE-POWER Connector | Provides means of externally controlling the amplitude of the RF signal frequency. |
| 11. | STEPPED CW/SWEPT Switch | Provides means of improving the incidental FM, when remotely programing the Ext Frequency Control mode for CW operation. |
| 12. | EXT CONTROL VOLTAGE-FREQ Connector | Provides means of externally controlling RF signal frequency (1 volt equal to 1 GHz, 2 volt equal to 2 GHz, etc.) |
| 13. | REF OUTPUT Connector | Provides direct coupled voltage equal to the RF frequency (1 volt equals 1 GHz, 2 volts equals 2 GHz, etc.) |
| 14. | PEN LIFT Connectors | Provides pen lift contact closure to recorder during sweep. Provides open circuit when SYNC lever (Figure 2-1, No. 33) is in the INT, LINE or TRIG positions, and the SWEEP TIME lever (Figure 2-1, No. 34) is in the 1-10 or 10-100 position. |

or STOP frequencies. Since the output frequency varies from the START frequency to the STOP frequency, sweeping can be either up or down with time.

NOTE

The Digital Frequency Selector selected on the left always represents the START frequency.

2-16. SWEEP SPEED - POWER OUTPUT CONSIDERATIONS

2-17. In order to utilize the maximum sweep speed (minimum sweep time) capabilities of the Model 9500 Sweeper, a 0.03 LIMIT position is indicated on the front panel SWEEP TIME VERNIER Control.

NOTE

When the SWEEP TIME (SEC) Lever is in the .01-.1 position and the sweep width is as wide as 2 GHz, the sweep time can be 0.03 seconds or slower without any significant changes in the RF power output level. If the Sweep Time is less than 0.03 seconds, it is possible to get some reduction of the RF power output level. This power level reduction must be considered when exact power levels are required in the measurement setup.

With careful consideration of sweep time and power output capabilities, it is possible to sweep faster than the 0.03 seconds limit position and wider band widths than 2 GHz. The automatic override SWEEP TIME (SEC) X10 Indicator Lamp will be actuated when the frequency control GHz digits exceed a difference of 3, i.e.,

2.000 to 5.999
2.999 to 5.999

Therefore, it is possible to sweep up to 4 GHz at sweep times faster than 0.1 seconds as shown in the above example.

2-18. In addition, sweeping can be automatically recurrent, synchronized with the line frequency, triggered or manually scanned, with variable sweep time for the recurrent line synchronized and triggered sweep. The modulation and leveling capabilities of the Sweeper can be used during START/STOP operation. Refer to paragraph 2-26 for proper START/STOP operation.

2-19. $\Delta$F SWEEP.

2-20. The $\Delta$F frequency varies equally above and below the selected center frequency set on the F1, M1, M2,or F2 Digital Frequency Selector. The peak to peak sweep width of the $\Delta$F frequency is adjustable from 0.1 to 100 MHz. All leveling, modulation, synchronization and sweep time capabilities of the sweeper can be used during $\Delta$F sweep operation. Refer to paragraph 2-27 for proper $\Delta$F Sweep operation.

2-21. CW MODE.

2-22. The CW mode provides operation at the selected frequency set on the F1, M1, M2 or F2 Digital Frequency Selector. During CW mode operation the synchronization, sweep time, RF blanking (retrace RF) and marker capabilities are inoperative. The modulation and and leveling capabilities of the Sweeper can be used during CW mode operation. Refer to paragraph 2-28 for proper CW mode operation.

2-23. PRE-OPERATION.

2-24. The following pre-operating procedure must be performed before operating the Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR.

a. Set the 115V/230V Slide Switch to the appropriate voltage position.

b. Connect the external power cable to the 115V/230V receptacle on the rear panel and to the AC power source.

c. Set the POWER switch to the ON position.

d. Connect the Sweeper to the unit under test.

2-25. OPERATING PROCEDURE.

2-26. START/STOP SWEEP.

a. Set the desired START frequency on the F1 Digital Frequency Selector.

b. Set the desired MARKER frequencies on the M1 and M2 Digital Frequency Selector.

c. Set the desired STOP frequency on the F2 Digital Frequency Selector.

d. Set the SYNC lever to the desired operating mode.

e. Set the SWEEP TIME (SEC) lever to the desired range.

f. Rotate the VERNIER Control for the desired sweep time.

g. Set the LEVELER lever to the desired mode.

NOTE

The UNLEVELED Indicator Lamp will go out when the power is leveled across the selected frequency range (lights when unleveled).

h. Depress the START/STOP, F1, and F2 Pushbutton Switches.

i. Rotate the RF POWER control for the desired power indication on the POWER DBM meter.

j. Set the MODULATION Lever to the desired type of modulation.

NOTE

If the MODULATION Lever is placed in the ⊓⊔ position, rotate the 800-1200 Hz Control for the desired square wave frequency.

k. Set the RETRACE RF Slide Switch to the desired position.

l. Rotate the MARKER WIDTH-AMPLITUDE Control (black knob) for the desired marker width, and the (red knob) for the desired amplitude.

2-27. ΔF SWEEP.

a. Set the desired center frequency on the F1, M1, M2, or F2 Digital Frequency Selector.

b. Depress the ΔF and the appropriate F1, M1, M2, or F2 Pushbutton Switches.

c. Rotate the WIDTH MHz-VERNIER Control (black knob) for the desired center frequency range, and the (red knob) for the desired sweep width within the selected range.

NOTE

Full clockwise rotation is the CAL (maximum) position in the selected range. The typical accuracy in this position is ±5%.

d. Repeat paragraph 2-26 steps d through l for all other front panel control settings required for ΔF Sweep operation.

2-28. CW OPERATION.

a. Set the desired CW frequency on the F1, M1, M2, or F2 Digital Frequency Selector.

NOTE

When the desired CW frequency is set on the F1 Digital Frequency Selector, rotate the FINE control for very accurate frequency settings.

b. Depress the CW and the F1, M1, M2, or F2 Pushbutton Switches.

c. Repeat paragraph 2-26 steps i and j for all other front panel control settings required for CW operation.

2-29. EXT FREQ CONT OPERATION.

a. Connect the external voltage source to the rear panel EXT CONTROL VOLTAGE-FREQ connector.

NOTE

The input voltage must be a minimum of +1.0 in order to obtain an RF output in EXT FREQ CONT operation.

b. Depress the EXT FREQ CONT pushbutton switch.

NOTE

If fast timing rate is not required during remote CW operation, set the rear panel STEPPED CW/SWEPT switch to the STEPPED CW position.

c. Repeat paragraph 2-26 steps f, h and i for all other front panel control settings required for EXT FREQ CONT operation.

2-30. APPLICATIONS INFORMATION.

2-31. The following figures indicate typical test setups which are useful for basic swept frequency test applications of the Narda Model 9500 1.0 to 12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR and its options and optional accessories.

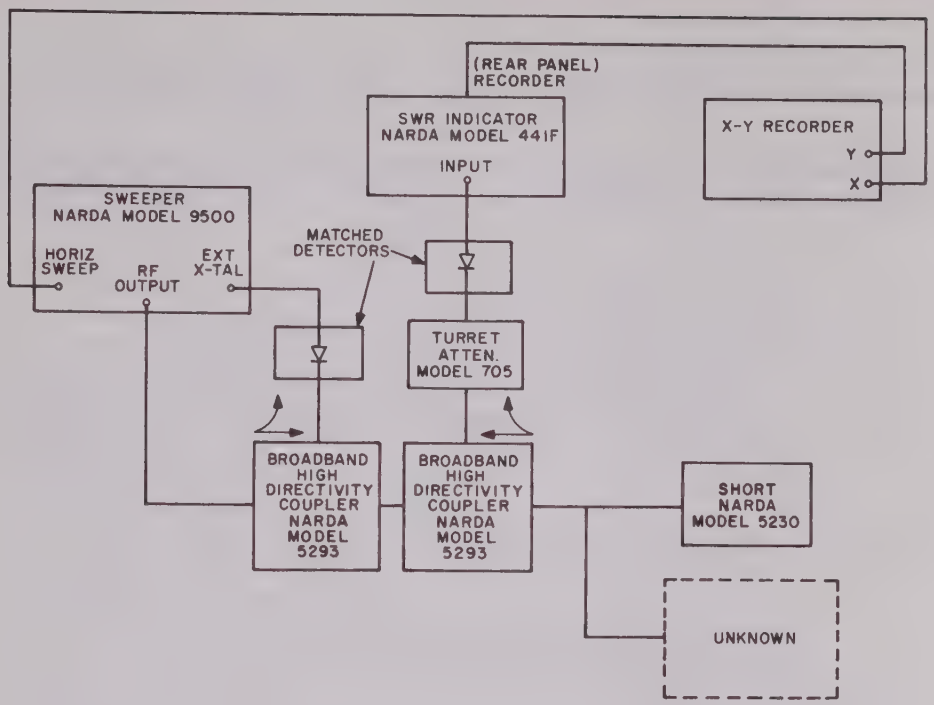



Figure 2-3. Typical Swept Frequency Reflectometer Setup

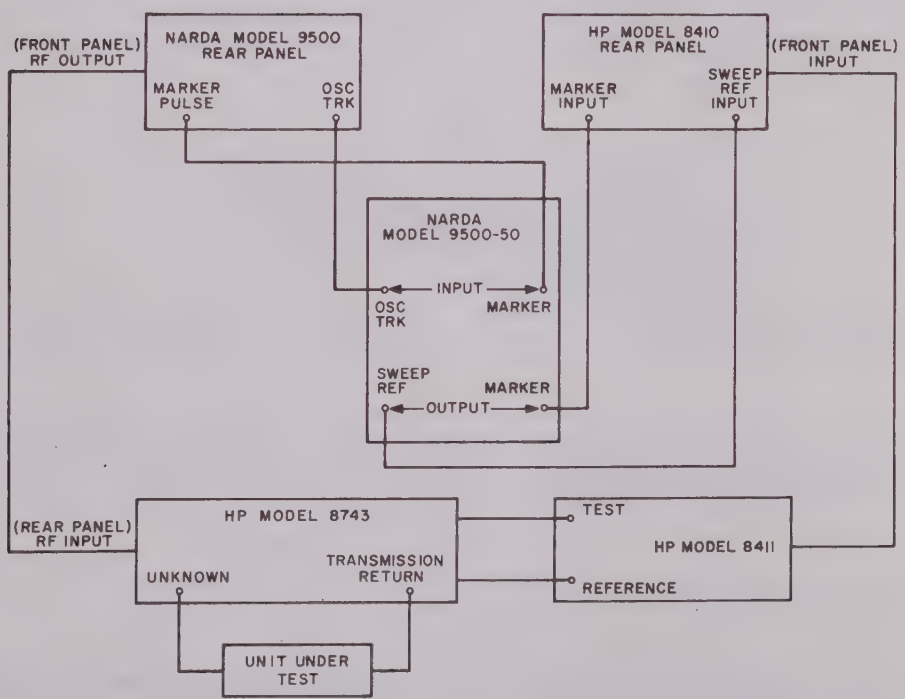



Figure 2-4. Typical Test Setup for Measuring Transmission Loss Using the Narda Model 9500 1.0 to 12.4 SOLID STATE SWEEPER and the HP 8410 Network Analyzer.

# SECTION III

# THEORY OF OPERATION

## 3-1. GENERAL.

3-2. This section provides a brief description of the major circuits of the Narda Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR. Figure 3-1 is a simplified block diagram showing the principal circuit sections. Figure 3-2, is a more complete block diagram and shows the main constituents of the circuit sections. Each circuit section and major individual circuits are explained in succeeding paragraphs. For the purpose of these discussions, the theory of operation is described with the Sweeper in the START/STOP mode of operation.

3-3. As illustrated in figure 3-1, the Sweeper consists of the Timing Section, Sweep Frequency Control Section, Modulation Control Section, RF and Leveling Section, and a Power Supply Section.

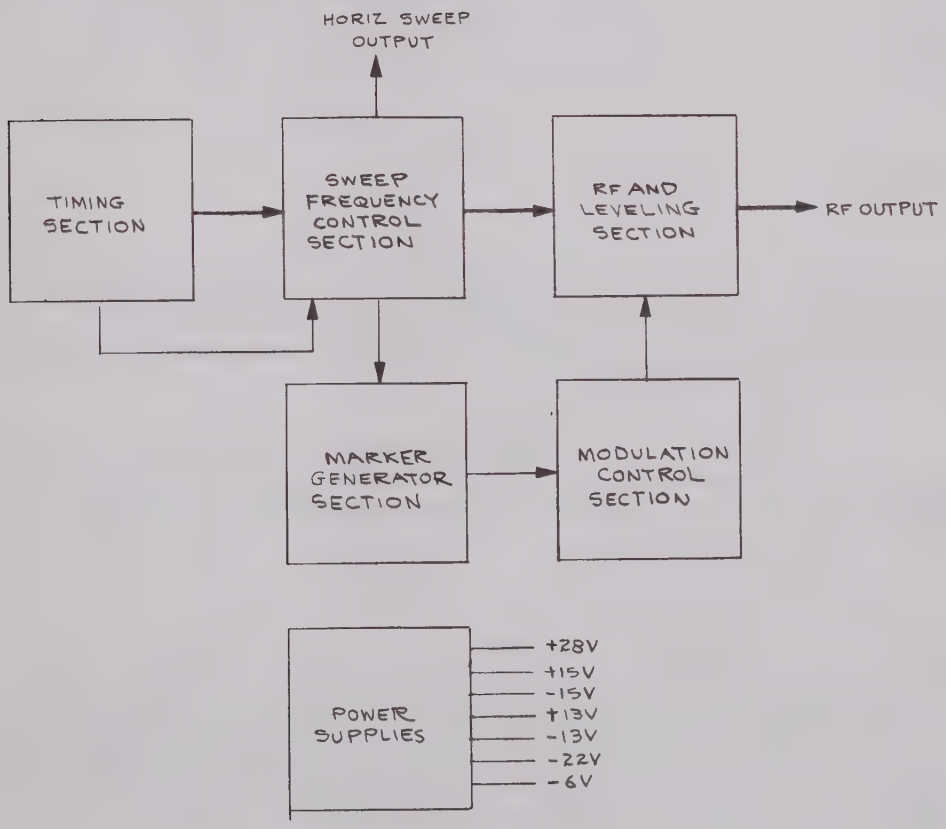



Figure 3-1. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Simplified Overall Block Diagram.

3-4. TIMING SECTIONS.

3-5. The Timing Section contains the basic rate generator, which controls the start of the ramp signal. It also contains the high and low limit detectors. The high limit detector senses the end of the retrace cycle, to ensure that a new sweep cannot be initiated until the preceeding sweep has completed its retrace cycle. The low limit detector senses the start of a new sweep. When the new sweep has started, the retrace cycle of the Miller Generator is started back to its positive saturation voltage.

3-6. SWEEP FREQUENCY CONTROL SECTION.

3-7. The Sweep Frequency Control Section generates a ramp voltage equal to the START/STOP frequency settings on the front panel F1 and F2 Digital Frequency Selectors (i.e., if F1 is set to 1.0 GHz and F2 is set to 12.4 GHz the ramp generated would be 1.0 to 12.4 volts). An override relay is provided to slow the Sweep Time by a factor of 10, if the sweep width exceeds the limitations of the Sweep Time, when the front panel SWEEP TIME (SEC) Lever is in the .01-.1 position.

3-8. When operating in the CW mode, the ramp is replaced by dc voltage equal to the front panel Digital Frequency Selector being used. When operating in the $\Delta F$ mode a small ramp is superimposed on the CW dc voltage. The superimposed ramp can be adjusted with the front panel WIDTH-MHz control.

3-9. MARKER AND BLANKING SECTION.

3-10. The Marker and Blanking Section samples the ramp voltage and generates marker pulses at the frequencies selected on the front panel Digital Frequency Selectors M1 and M2. The modulation summing amplifier sums the external or internal modulation and the frequency markers. The pulse width and amplitude are adjustable by the front panel WIDTH and AMPLITUDE controls respectively.

3-11. Retrace blanking providing automatic turn-off of the swept signal during automatic recurrent and triggered cycles, when the front panel RF RETRACE Slide Switch is in the BLANK position, is also provided.

3-12. RF AND LEVELING SECTION.

3-13. The RF and Leveling Section samples the ramp voltage, which is used to drive the RF Oscillator. The output of the oscillator is fed to the diode switch which provides the control for RF Modulation, RF Amplitude Control and Leveling capability. The optional directional detector or the external detector feeds the leveler amplifier which activates the diode switch driver and relay and in turn drives the diode switch.

3-14. Switchpoint blanking is generated at the switchover point from one harmonic of the RF Oscillator frequency to another, and is generated in coincidence with the Switchover time dwell.

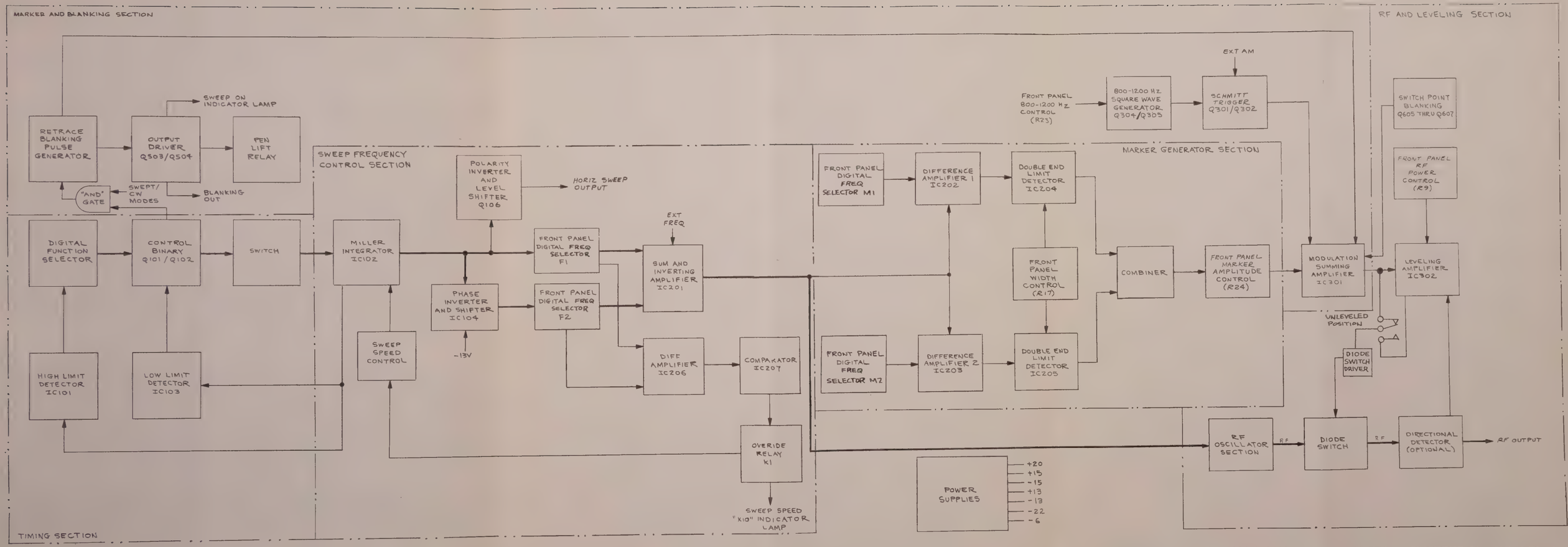



Figure 3-2. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Simplified Block Diagram.

3-15. THEORY OF OPERATION.

3-16. POWER SUPPLIES. (Refer to figure 3-3.)

3-17. The main power supply in the Sweeper provides all the required operating voltages and consists of seven regulated power supplies providing +28, +15, -15, +13, -13, -22 and -6 volts.

3-18. 115 or 230 VAC is applied to power transformer T1 through power switch S9, ground hum prevention relay K3A/K3B, thermostat switch S20 and AC voltage selector switch S8. The transformer is connected to the standard bridge rectifier circuits for each of the individual power supplies.

3-19. +28 VOLT POWER SUPPLY. (Refer to figure 6-6.)

3-20. The +28 volt regulated power supply standard bridge rectifier consists of diodes CR11 through CR14; the output is +42 VDC nominal. Capacitor C9 filters the rectifier output. Relay K4 provides overvoltage protection and feeds the rectifier output to pass transistor Q1, emitter follower transistor Q506, supplies bias to pass transistor Q1. Current limiting transistor Q505 limits the current in case of a short circuit. Load current flows through current sensing resistors R36 and R37 at all times and applies the voltage drop to current limiting transistor Q505. Voltage reference diode CR506 and bleeder resistor R509 establish the reference voltage which is applied to High Gain Amplifier IC502. An adjustable output sample voltage is provided by the voltage divider consisting of resistors R510, R511 and R512. Variable resistor R511 (+28V ADJ) adjusts the regulated output voltage to +28 volts. Unregulated power is applied to the RC network consisting of resistor R525 and charging capacitor C505. As capacitor C505 charges the current applied to the base of emitter follower transistor Q508 increases, is amplified and fed through limiting resistor R523 to the base of pass transistor Q3, when saturation is reached, Q3 is biased on and a delayed +28 volts is obtained at the emitter.

3-21. +15 VOLT AND +13 VOLT POWER SUPPLIES. (Refer to figure 6-5.)

3-22. The output of the +15 volt regulated power supply standard bridge rectifier CR401 is +20.5 VDC nominal. This output is fed to pass transistor Q401, emitter follower Q402 supplies bias to the pass transistor. Capacitor C401 filters the bridge rectifier output. Overvoltage clamping is provided by zener diode CR4. Current limiting transistor Q403 limits the current in case of a short circuit. Load current flows through current sensing resistor R401 at all times, and applies the voltage drop to the current limiting transistor. Voltage reference diode CR405 and limiting resistor R402 establish the reference voltage which is applied to High Gain Amplifier IC402. An adjustable output sample voltage is provided by the voltage divider consisting of resistors R404, R405 and R406. Variable resistor R405 (+15V ADJ) adjusts the regulated output voltage to +15 volts.

3-23. The regulated +15 volt output of the +15 volt power supply is applied to pass transistor Q404. The emitter output of the pass transistor is fed to High Gain Amplifier IC402. An adjustable output sample voltage is provided by the voltage divider consisting of resistors R409, R410 and R411. Variable resistor R410 (+13V ADJ) adjusts the regulated output voltage to +13 volts.

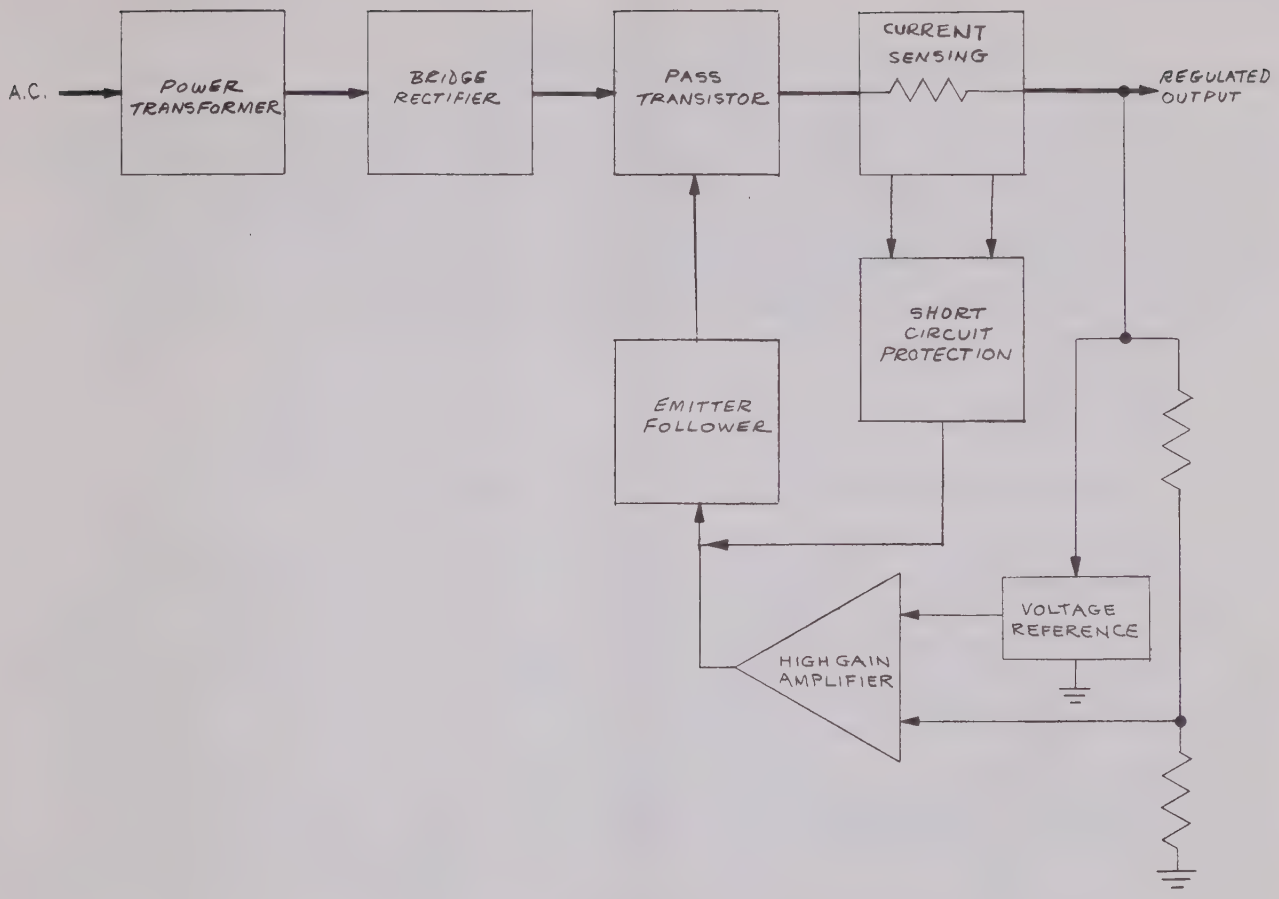



Figure 3-3. Typical Regulated Power Supply Simplified Block Diagram

3-24. -15 VOLT AND -13 VOLT POWER SUPPLIES. (Refer to figure 6-5.)

3-25. The -15 volt and -13 volt power supply theory of operation is identical to the +15 volt and +13 volt power supplies described in paragraphs 3-22 and 3-23. -15 volt regulated output adjustment is provided by variable resistor R417 (-15 VOLT ADJ), the -13 volt regulated output adjustment is provided by variable resistor R424 (-13V ADJ).

3-26. -22 VOLT POWER SUPPLY. (Refer to figure 6-6.)

3-27. The output of the -22 volt regulated power supply standard bridge rectifier CR501 is -30 VDC nominal. This output is fed to the control transistor Q501. Capacitor C501 filters the rectifiers output. Current limiting transistor Q502 is in series with the control transistor and limits the current in case of a short circuit. Load current flows through current sensing resistor R501 at all times and applies the voltage drop to the current limiting transistor. The regulated output of the rectifier is fed to High Gain Amplifier IC501. Voltage reference is provided by the +13 volt power supply. An adjustable output sample voltage is provided by the voltage divider consisting of resistors R502, R503 and R504. Variable resistor R503 (-22V ADJ) adjusts the regulated output voltage to -22 volts.

3-28. -6 VOLT POWER SUPPLY. (Refer to figure 6-6.)

3-29. The output of -6 volt regulated power supply standard bridge rectifier CR15 is -9 VDC nominal. This output is fed through voltage dropping resistors R44 and R520 to emitter follower Q507 and control transistor Q2. The emitter follower supplies bias to the control transistor. Capacitor C13 filters the rectifier output. Voltage reference diode CR510 and limiting resistor R516 establishes the reference voltage which is applied to High Gain Amplifier IC503. An adjustable output sample voltage is provided by the voltage divider consisting of resistors R518, R515 and R516. Variable resistor R515 (-6V ADJ) adjusts the regulated output voltage to -6 volts.

3-30. Deleted

3-31. SWEEP FREQUENCY CONTROL SECTION. (Refer to figures 3-4 and 6-2.)

3-32. Miller integrator IC102 generates a +13 to 0 volt ramp which is applied to phase inverter and shifter IC104 and F1 front panel Digital Display Counter (voltage divider). The phase inverter and shifter changes the ramp to a 0 to +13 volt ramp, which in turn is applied to F2 front panel Digital Display Counter (voltage divider). The outputs of F1 and F2 are then fed to summing and inverting amplifier IC201 and difference amplifier IC206. The summing and inverting amplifier provides a ramp voltage equal to the START/STOP frequency settings on F1 and F2 front panel Digital Frequency Selectors (i.e., if F1 is set to 1.0 GHz and F2 is set to 12.4 GHz the ramp generated would be -1.0 to -12.4 volts). The difference amplifier samples the output ramps produced by the F1 and F2 voltage dividers and compares the difference with the reference sweep width in comparator IC207. Override relay K1 shows the sweep time by a factor of 10, if the sweep width exceeds the limitations of the Sweep Time set on the front panel. The override relay will only function when the SWEEP TIME Lever is in the 0.1-.1 position.

3-33. TIMING SECTION. (Refer to figure 3-5 and 6-2.)

3-34. The SYNC and Sweep Mode input information are combined in a NAND gate with the high limit detector, IC101. IC101 detects the end of a retrace. This ensures that a new sweep can not be initiated until the preceding sweep has completed its retrace cycle. The output of the NAND gate is applied to control binary flip flop Q101/Q102. The flip flop is also driven by low limit detector IC103 which detects the start of a sweep. The low limit detector causes the binary to close the switch at the Miller integrator ramp generator. The closing of the switch starts the ramp generator retrace cycle back to positive saturation voltage.

3-35. MARKER GENERATOR. (Refer to figures 3-6 and 6-3.)

3-36. Difference amplifier IC202 samples the ramp voltage and subtracts it from the reference voltage generated by the front panel Digital Display M1 control (voltage divider). The resultant shifted sawtooth signal is fed to double end limit detector IC204. IC204 acts as a comparator which is centered at zero volts and converts the voltage output into a marker pulse. The pulse width is adjustable by front panel WIDTH control potentiometer R17, by setting the voltage between the detector end limits. The marker pulse is then fed through the OR gate combiner and applied to modulation summing amplifier IC302. Front panel Marker AMPLITUDE control potentiometer R24 permits adjustment of the pulse amplitude.

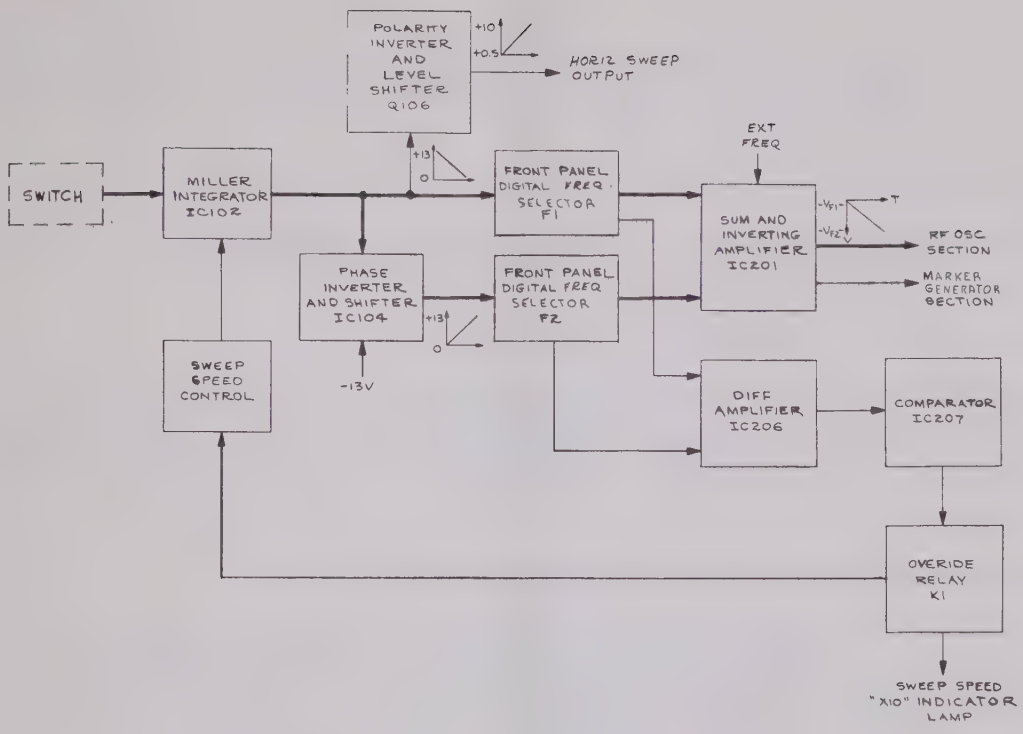



Figure 3-4. Sweep Frequency Control Section Simplified Block Diagram

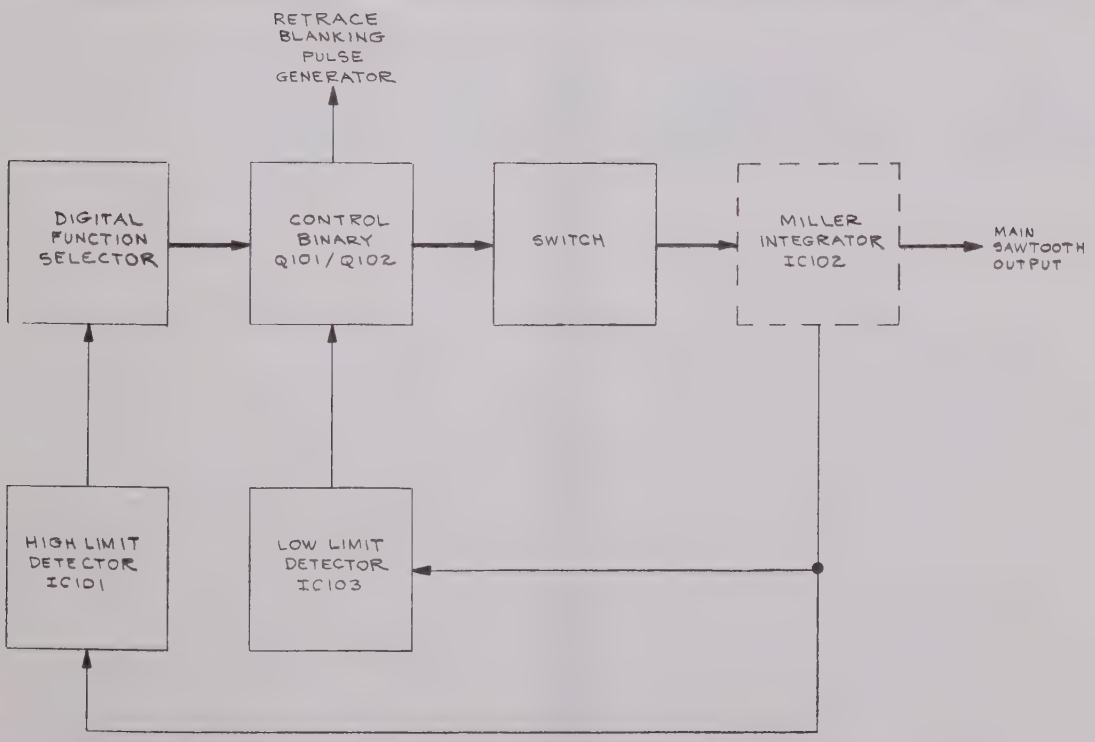



Figure 3-5. Timing Section Simplified Block Diagram.

3-37. The operation of difference amplifier IC202 with respect to the front panel Digital Display Control (voltage divider) and its associated double end limit detector IC204 are identical to that described in paragraph 3-36.

3-38. PULSE MODULATION. (Refer to figures 3-6 and 6-4.)

3-39. Schmitt trigger Q301/Q302 applies the (internal or external) modulation to modulation summing amplifier IC302, where it is summed with the marker pulses.

3-40. BLANKING. (Refer to figures 3-6 and 6-3.)

3-41. Retrace blanking is generated by the AND gate inputs from control binary Q101/Q103. The voltage on the AND gate is amplified and balanced to zero volts, and then applied to modulation summing amplifier IC301. The AND gate inputs from the front panel EXT FREQ CONT and CW pushbutton switches and the SYNC, MAN SCAN control removes the blanking voltages.

3-42. RF AND LEVELING. (Refer to figures 3-7 and 6-4.)

3-43. The optional directional detector feeds the leveler amplifier, which in turn controls the diode switch driver. The diode switch driver and relay allows the signal from the modulation summing amplifier to bypass the leveling amplifier, to provide faster rise time when operating in the unleveled condition. The output of the RF oscillator is fed to the diode switch. The diode switch provides the control for RF modulation, RF amplitude control and the leveling capability. The output of the diode switch is fed directly to the directional detector and front panel RF OUTPUT connector.

3-44. Switchpoint blanking is generated in the RF section at the switchover point from one harmonic of the RF oscillator frequency to another. The 12 Msec pulse blanks the RF frequency while the RF oscillator is returning to the lowest fundamental frequency. This blanking pulse is generated in coincidence with the switchover time dwell.

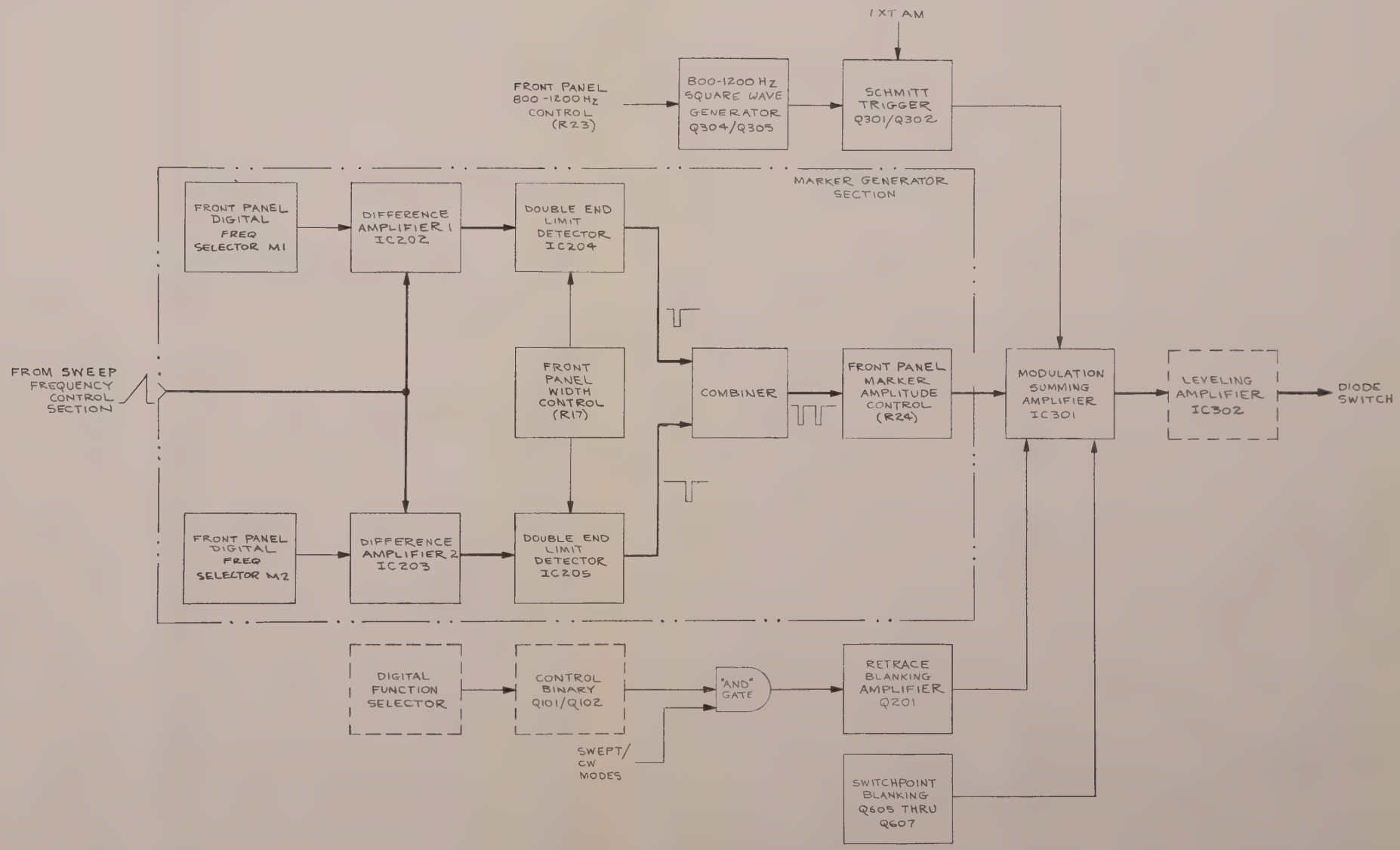

EXT AM
FRONT PANEL 800-1200 Hz CONTROL (R23)
800-1200 Hz SQUARE WAVE GENERATOR Q304/Q305
SCHMITT TRIGGER Q301/Q302
MARKER GENERATOR SECTION
FRONT PANEL DIGITAL FREQ SELECTOR M1
DIFFERENCE AMPLIFIER 1 IC202
DOUBLE END LIMIT DETECTOR IC204
FROM SWEEP FREQUENCY CONTROL SECTION
FRONT PANEL WIDTH CONTROL (R17)
COMBINER
FRONT PANEL MARKER AMPLITUDE CONTROL (R24)
MODULATION SUMMING AMPLIFIER IC301
LEVELING AMPLIFIER IC302
DIODE SWITCH
FRONT PANEL DIGITAL FREQ SELECTOR M2
DIFFERENCE AMPLIFIER 2 IC203
DOUBLE END LIMIT DETECTOR IC205
DIGITAL FUNCTION SELECTOR
CONTROL BINARY Q101/Q102
"AND" GATE
RETRACE BLANKING AMPLIFIER Q201
SWEPT/ CW MODES
SWITCHPOINT BLANKING Q605 THRU Q607

Figure 3-6. Modulation Control Simplified Block Diagram.

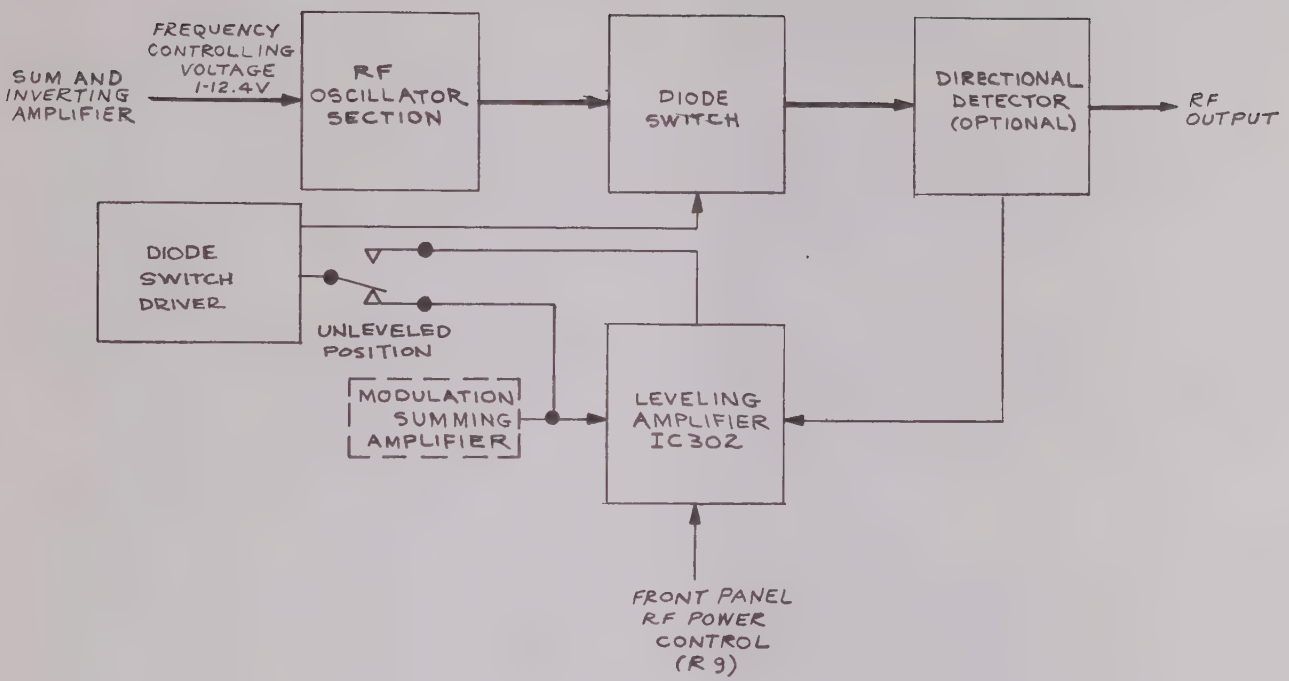



Figure 3-7. RF and Leveling Simplified Block Diagram

# SECTION IV

# MAINTENANCE

## 4-1. GENERAL.

4-2. This section provides information for the troubleshooting and maintenance of the Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR electronic circuitry.

CAUTION

DO NOT REMOVE THE BOTTOM PANEL OF THIS UNIT.

Maintenance information has not been provided for the RF Section of this unit. The complex design of this section and the terms of the unconditional warranty make it impractical to perform this maintenance in the field.

The unit must, therefore, be returned to Narda for all maintenance and troubleshooting of the RF Section, located under the Bottom Panel. The unbroken seal is your protection under the warranty.

## 4-3. REQUIRED TEST EQUIPMENT.

4-4. The following test equipment will be required to perform maintenance on the Model 9500 Sweeper.

| | |
|---|---|
| a. Pulse Generator | General Radio 1217C or equivalent |
| b. Variable Autotransformer | Variac W5M or equivalent |
| c. Oscilloscope with High Gain Differential Oscilloscope Plug-In | Tektronix 545B and Tektronix 1A7A or equivalents |
| d. Fast Rise time Oscilloscope Plug-In | Tektronix Type K or equivalent |
| e. Voltage Probe 1X (2 required) | Tektronix P6028 or equivalent |
| f. DC Differential Voltmeter | Fluke 885AB or equivalent |
| g. Volt-Ohm-Milliammeter | Simpson 270 or equivalent |
| h. Regulated Power Supply | Lambda LP412FM or equivalent |
| i. Frequency Meter | HP536A and HP537A or equivalents |
| j. Crystal Detector (2 required) | Alfred 1001 or equivalent |
| k. 10dB Coupler | Narda 3202B-10 or equivalent |
| l. Attenuator | Narda 757C-10 or equivalent |
| m. Power Meter | Narda 443 and 471 or equivalents |
| n. Frequency Counter | HP524L and 5260A or equivalents |
| p. Coaxial Adapter (NPM-Male to N-Female) | Narda 56 or equivalent |

4-5. PERFORMANCE CHECK.

4-6. This performance check may be used as a routine maintenance procedure to verify the performance of the Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR.

4-7. INITIAL SETUP. (Refer to figure 4-1.)

a. Set the 115V/230V Slide Switch to the desired position.

CAUTION

Ensure the Sweeper POWER Switch is in the Off position.

b. Connect the external power cable to the 115V/230V receptable on the rear panel, and the external power source.

c. Remove the four mounting screws in the Sweeper top cover and remove the cover.

4-8. POWER SUPPLIES.

4-9. VOLTAGE MEASUREMENTS.

a. Set the DC Differential Voltmeter to the 50V, -DC scale.

b. Connect the DC Differential Voltmeter (+) lead to Test Point TP501, on the Sweeper number 500 printed circuit board, connect the common lead to any convenient chassis ground.

c. Set the Sweeper POWER Switch to the On position.

d. Observe the DC Differential Voltmeter indication; it should be -22 volts ±10 mV.

e. Remove the DC Differential Voltmeter (+) lead from TP501 and connect the lead to Test Point TP403, on the Sweeper number 400 printed circuit board.

f. Observe the DC Differential Voltmeter indication; it should be -15 volts ±20 mV.

g. Remove the DC Differential Voltmeter (+) lead from TP403 and connect the lead to Test Point TP401, on the Sweeper number 400 printed circuit board.

h. Observe the DC Differential Voltmeter indication; it should be -13 volts ±10 mV.

i. Remove the DC Differential Voltmeter (+) lead from TP401.

j. Set the DC Differential Voltmeter to the 10V, -DC scale.

k. Connect the DC Differential Voltmeter (+) lead to Test Point TP503, on the Sweeper number 500 printed circuit board.

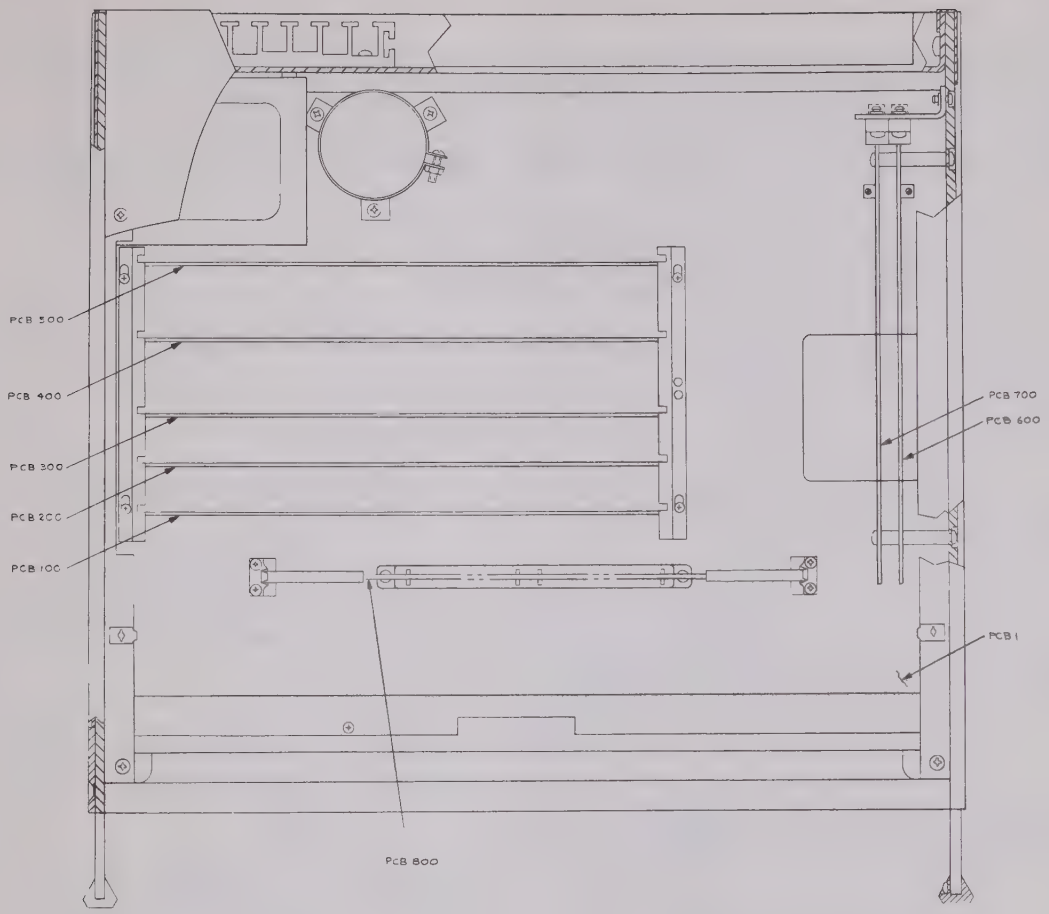



Figure 4-1. Model 9500 Printed Circuit Board Locations

l. Observe the DC Differential Voltmeter indication; it should be -6 volts ±10 mV.

m. Remove the DC Differential Voltmeter (+) lead from Test Point TP503.

n. Set the DC Differential Voltmeter to the 50V, +DC scale.

p. Connect the DC Differential Voltmeter (+) lead to Test Point TP502, on the Sweeper number 500 printed circuit board.

q. Observe the DC Differential Voltmeter indication; it should be +28 volts ±10 mV.

r. Remove the DC Differential Voltmeter (+) lead from TP502 and connect the lead to Test Point TP402, on the Sweeper number 400 printed circuit board.

s. Observe the DC Differential Voltmeter indication; it should be +15 volts ±20 mV.

t. Remove the DC Differential Voltmeter (+) lead from TP402 and connect the lead to Test Point TP404, on the Sweeper number 400 printed circuit board.

u. Observe the DC Differential Voltmeter indication; it should be +13 volts ±10 mV.

v. Remove both DC Differential Voltmeter leads.

4-10. PEAK-TO-PEAK RIPPLE VOLTAGE CHECK.

a. Ground the Oscilloscope to the buss bar at the front of the Sweeper under test using a grounding strap.

b. Adjust the Oscilloscope for internal triggering.

c. Connect the Oscilloscope lead with the 1X probe to Test Point TP501, on the number 500 printed circuit board.

d. Observe the Oscilloscope indication; it should be < 1 mV peak-to-peak.

e. Remove the Oscilloscope probe from TP501 and connect the probe to Test Point TP502, on the number 500 printed circuit board.

f. Observe the Oscilloscope indication; it should be < 50 mV peak-to-peak.

g. Remove the Oscilloscope probe from TP502 and connect the probe to Test Point TP402, on the number 400 circuit board.

h. Observe the Oscilloscope indication; it should be < 5 mV peak-to-peak.

i. Remove the Oscilloscope probe from TP402 and connect the probe to Test Point TP404, on the number 400 printed circuit board.

j. Observe the Oscilloscope indication; it should be < 500 $\mu$V peak-to-peak.

k. Remove the Oscilloscope probe from TP404 and connect the probe to Test Point TP403, on the number 400 printed circuit board.

l. Observe the Oscilloscope indication; it should be < 5 mV peak-to-peak.

m. Remove the Oscilloscope probe from TP403 and connect the probe to Test Point TP401, on the number 400 printed circuit board.

n. Observe the Oscilloscope indication; it should be < 500 $\mu$V peak-to-peak.

4-11. LINE VOLTAGE REGULATION.

a. Connect the variable Autotransformer (Variac) between the line voltage source and the Sweeper under test.

b. Connect the DC Differential Voltmeter to Test Point TP501, on the Sweeper number 500 printed circuit board.

c. Vary the line voltage from 127 volts to 95 volts. Observe the power supply does not break regulation until the line voltage is below 100 volts.

d. Connect the DC Differential Voltmeter to each of the following Test Points and repeat step c.

| Test Point | Printed Circuit Board Number |
|---|---|
| TP502 | 500 |
| TP402 | 400 |
| TP403 | 400 |
| TP503 | 500 |

e. Set the Sweeper POWER Switch to the Off position.

4-12. RAMP GENERATOR.

a. Place the number 100 printed circuit board on the extension connector and reinsert the board in the unit under test. (Refer to figure 4-1.)

b. Set the Sweeper POWER Switch to the On position.

c. Set the Sweeper controls as follows:

| Control | Setting |
|---|---|
| F1 Digital Frequency Selector | 1.000 |
| M1 Digital Frequency Selector | 3.000 |
| M2 Digital Frequency Selector | 4.000 |
| F2 Digital Frequency Selector | 2.000 |
| SWEEP TIME Lever | .01 - .1 |
| SYNC Lever | MAN SCAN |
| MAN SCAN Control | Full counterclockwise |
| VERNIER Control | Full counterclockwise |
| WIDTH-MHz Control | 100 |
| MODULATION Lever | OFF |
| LEVELER Lever | RF OFF |
| AMPLITUDE Control | Full clockwise |
| MARKER Control | Mid rotation position |
| START/STOP Pushbutton Switch | Depressed |
| F1 Pushbutton Switch | Depressed |
| F2 Pushbutton Switch | Depressed |

d. Connect the DC Differential Voltmeter to Test Point TP104, on the number 100 printed circuit board.

e. Observe the DC Differential Voltmeter indication; it should be 13.00 ±0.01 volts.

f. Disconnect the DC Differential Voltmeter from Test Point TP104, and connect the oscilloscope probe to TP104.

g. Adjust the Oscilloscope as follows:

| Oscilloscope and Plug-In Controls | Position |
|---|---|
| AC-GND-DC Input | GND |
| VOLTS/CM | 100 mV |
| TIME/CM | 20 msec |

h. Adjust the Oscilloscope for a zero reference.

i. Set the Sweeper SYNC Lever to the INT position.

j. Set the AC-GND-DC Input Lever, on the Oscilloscope Plug-In, to the DC position.

k. Observe the Oscilloscope indication; the negative peak of the sawtooth waveform should be within 100 mV of the zero reference.

l. Set the Sweeper SYNC Lever to the MAN SCAN position.

m. Disconnect the Oscilloscope leads.

n. Connect the DC Differential Voltmeter to Test Point TP105, on the Sweeper number 100 printed circuit board.

p. Rotate the Sweeper MAN SCAN Control to the full clockwise position.

q. Observe the DC Differential Voltmeter indication; it should be a varying signal of 0 to 13 volts.

r. Rotate the Sweeper MAN SCAN Control to the full counterclockwise position.

s. Observe the DC Differential Voltmeter indication; it should be within 40 mV of zero.

4-13. SUMMING AMPLIFIER.

a. Remove the extension connector from the Sweeper number 100 printed circuit board and reinsert board in the unit under test; place the number 200 printed circuit board on the extension connector and reinsert in the unit.

b. Connect the DC Differential Voltmeter to Test Point TP203, on the Sweeper number 200 printed circuit board.

c. Set the Sweeper F1 Digital Frequency Selector to 1.000 GHz and the F2 Digital Display Counter to 12.400 GHz.

d. Set the Sweeper SYNC Lever to the MAN SCAN position.

e. Rotate the Sweeper MAN SCAN Control to the full counterclockwise position.

f. Observe the DC Differential Voltmeter indication; note the difference from the indication of 1.000 volts.

g. Rotate the Sweeper MAN SCAN Control to the full clockwise position.

h. Observe the DC Differential Voltmeter indication; note the difference from the indication of 12.400 volts.

i. The differences observed in steps e and g should be equal.

4-14. MARKER GENERATORS.

a. Set the Sweeper SYNC Lever to the INT position.

b. Connect the Oscilloscope Horizontal input to the Sweeper HORIZ SWEEP Connector, and the Vertical input to the Sweeper rear panel MARKER PULSE Connector.

c. Set the Sweeper F2 Digital Frequency Selector to 11.000 GHz.

d. Set the HORIZ DISPLAY Control on the Oscilloscope to the EXT position.

e. Set the Variable 10-1 Control on the Oscilloscope for 10 cm.

f. Observe the Oscilloscope indication; it should be 10 cm wide.

g. Set the Sweeper M2 Digital Frequency Selector to 12.000 GHz.

h. Set the Sweeper M1 Digital Frequency Selector to 1.000 GHz.

i. Observe the Oscilloscope indication; the marker signal should appear at 0 cm.

j. Increase the frequency indication on the Sweeper M1 Digital Frequency Selector in 100 MHz steps to 2.000 GHz. Observe the position of the marker signal on the Oscilloscope; it should move to the right (1 cm equals 1 GHz).

k. Increase the frequency indication on the Sweeper M1 Digital Frequency Selector in 1 GHz steps to 11.000 GHz. Observe the position of the marker signal on the Oscilloscope; it should move to the right.

l. Set the Sweeper M2 Digital Frequency Selector to 1.000 GHz.

m. Repeat steps i through k using the Sweeper M2 Digital Frequency Selector.

4-15. SWEEP RATE LIMITER.

a. Set the Sweeper F1 Digital Frequency Selector to 1.000 GHz and the F2 Digital Frequency Selector to 2.000 GHz .

b. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp does not light.

NOTE

The Sweeper SWEEP TIME (SEC) X10 Indicator Lamp will not light, if the difference frequency indicated on the F1 and F2 Digital Frequency Selector is less than 4.000 GHz.

c. Increase the frequency indication on the Sweeper F2 Digital Frequency Selector 3 GHz to read 5.000 GHz.

d. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp lights.

e. Increase the frequency indication on the Sweeper F1 Digital Frequency Selector 3 GHz to read 4.000 GHz.

f. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp does not light.

g. Repeat steps c through f increasing the Sweeper F1 and F2 Digital Frequency Selector 3 GHz until F1 indicates 10.000 GHz and F2 indicates 11.000 GHz.

h. Set the Sweeper F1 Digital Frequency Selector to 12.000 GHz and the F2 Digital Display Counter to 11.000 GHz.

i. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp does not light.

j. Decrease the frequency indication on the Sweeper F2 Digital Frequency Selector 3 GHz to read 8.000 GHz.

k. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp lights.

l. Decrease the frequency indication on the Sweeper F1 Digital Frequency Selector 3 GHz to read 9.000 GHz.

m. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp does not light.

n. Repeat steps j through m decreasing the Sweeper F1 and F2 Digital Frequency Selector 3 GHz until F2 indicates 2.000 GHz and F1 indicates 3.000 GHz.

p. Repeat steps a through n using the M1 and M2 Digital Frequency Selectors.

4-16. BLANKING PULSE.

a. Set the Sweeper SYNC Lever to the TRIG position.

b. Connect the Oscilloscope probe to the wiper arm of BLANKING ZERO BAL. (R240), on the Sweeper number 200 printed circuit board.

c. Set the Sweeper RETRACE RF Slide Switch to the BLANK position.

d. Observe the Oscilloscope indication; it should be > -2 volts.

4-17. MODULATION CIRCUITS.

a. Set the Sweeper MODULATION Lever to the OFF position.

b. Place the Fast Rise Preamplifier Plug-In unit in the Oscilloscope and connect the X10 probe.

c. Remove the extension connector from the Sweeper number 200 printed circuit board and reinsert the board in the Sweeper under test; place the Sweeper number 300 printed circuit board on the extension connector and reinsert into the unit.

d. Depress the Sweeper CW and F1 Pushbutton Switches.

e. Connect the Oscilloscope probe to Test Point TP302, on the Sweeper number 300 printed circuit board.

f. Observe the Oscilloscope indication; it should be -2 volts dc.

g. Set the Sweeper MODULATION Lever to the ⊔⊓ position.

h. Observe the Oscilloscope indication; it should be a 3 volt peak-to-peak square wave with the negative peak at -2 volts.

i. Set the Sweeper MODULATION Lever to the OFF position.

j. Set the Sweeper LEVELER Lever to the EXT position.

NOTE

If the Model 9500 Option 01 is incorporated in the unit under test, reference to the Sweeper LEVELER Lever EXT position should be changed to the INT position.

k. Connect the Power Meter to the Sweeper RF OUTPUT connector.

l. Adjust the RF POWER Control for a 1 mW indication on the Power Meter.

m. Disconnect the Power Meter from the Sweeper RF OUTPUT Connector and connect the Sweeper, Attenuator, Crystal Detector and Oscilloscope as shown in figure 4-2.

n. Set the Sweeper MODULATION Lever to the ⊔⊓ position.

p. Adjust the Oscilloscope for a two cycle square wave indication.

q. Rotate the Sweeper 800-1200 Hz Control to the full counterclockwise position.

r. Observe the Oscilloscope indication; it should be a square wave period of greater than 1.25 msec (less than 800 Hz).

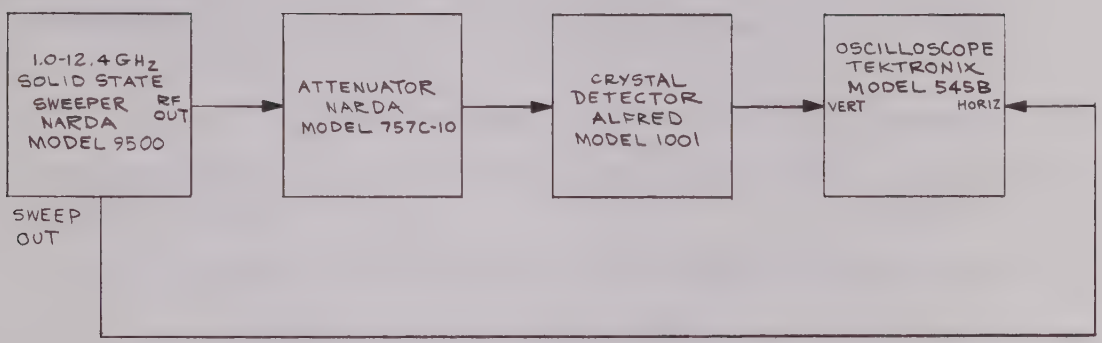



Figure 4-2. Modulation Circuits Test Setup

s. Rotate the Sweeper 800-1200 Hz Control to the full clockwise position.

t. Observe the Oscilloscope indication; it should be a square wave period of less than 830 $\mu$sec (greater than 1200 Hz).

u. Set the Sweeper MODULATION Lever to the EXT AM position.

v. Connect the Pulse Generator to the Sweeper EXT MOD Connector.

w. Set the Sweeper LEVELER Lever to the UNLEVELED position.

x. Adjust the Pulse Generator for a 10 $\mu$sec pulse width and sufficient duty cycle to obtain a convenient Oscilloscope indication.

y. Adjust the Pulse Generator output (starting at zero volts) for a good Oscilloscope reproduction of the input shape.

z. Connect the Oscilloscope to the Sweeper EXT MOD Connector using a "Tee" connector.

aa. Observe the Oscilloscope indication; the amplitude should be less than 15 volts peak.

ab. Set the MODULATION Lever to the OFF position.

ac. Disconnect the unit under test from the test setup.

4-18. EXTERNAL SYNCHRONIZED OPERATION.

a. Set the Sweeper SYNC Lever to the TRIG position.

b. Connect the Pulse Generator to the Sweeper EXT Connector.

c. Set the Pulse Generator pulse width to 1.0 $\mu$sec.

d. Connect the Oscilloscope to the Sweeper HORIZ SWEEP Connector.

e. Set the Sweeper SWEEP TIME (SEC) Lever to the .01-.1 position.

f. Increase the Pulse Generator output voltage from 0 volts until the indication on the Oscilloscope starts to sweep.

g. Connect the Pulse Generator to the TRIGGER Connector on the Oscilloscope using a "Tee" Connector.

h. Set the Oscilloscope TRIGGER MODE Switch to the EXT position.

i. Observe the Oscilloscope indication; it should be synchronized with the Pulse Generator at a rate of less than 100 pulses per second.

j. Measure the pulse amplitude of the Oscilloscope indication at the point that the sweep starts; it should be less than +15 volts peak.

k. Disconnect the Pulse Generator from the Oscilloscope and the Sweeper.

l. Set the Sweep time on the Oscilloscope to 2 seconds/cm.

m. Depress the Sweeper SINGLE Trigger Sweep Pushbutton Switch.

n. Observe the Oscilloscope indication; only one sweep should be initiated.

4-19. AUXILIARY OUTPUTS.

a. Set the Sweeper SWEEP TIME (SEC) Lever to the .01-.1 position.

b. Set the Sweeper F1 Digital Frequency Selector to 1.000 GHz, the M1 Digital Frequency Selector to 2.000 GHz, the M2 Digital Frequency Selector to 3.000 GHz and the F2 Digital Frequency Selector to 4.000 GHz.

c. Connect the Oscilloscope to the Sweeper rear panel SWEEP OUT Connector.

d. Observe the Oscilloscope indication; it should be a positive sawtooth of approximately 0 volts to > 10 volts.

e. Disconnect the Oscilloscope from the Sweeper rear panel SWEEP OUT Connector and connect it to the MARKER PULSE Connector.

f. Observe the Oscilloscope indication; it should be two negative pulses with an amplitude of -2.0 ±0.5 volts and located at the 1/3 and 2/3 points on the sweep.

g. Disconnect the Oscilloscope from the Sweeper rear panel MARKER PULSE Connector and connect it to the RETRACE BLANKING Connector.

h. Observe the Oscilloscope indication; it should be a +28 volt pulse for the duration of the retrace cycle.

i. Disconnect the Oscilloscope from the Sweeper rear panel RETRACE BLANKING Connector and connect it to the OSC TRK Connector.

j. Depress the Sweeper START/STOP, F1 and M2 Pushbutton switches.

k. Observe the Oscilloscope indications; it should be a sawtooth waveform of 2.6 to 5.2 volts.

l. Disconnect the oscilloscope leads.

m. Connect the Volt-ohm-Milliameter (Ohmmeter) between the Sweeper rear panel PEN LIFT plotting terminals.

n. Set the Ohmmeter to the RIX scale.

p. Set the Sweeper SWEEP TIME (SEC) Lever to the 1-10 position.

q. Rotate the Sweeper VERNIER clockwise for a sweep time of over 5 seconds.

r. Observe the Ohmmeter indication; it should indicate continuity during the retrace and dwell cycles and an open circuit during the sweep cycle.

s. Disconnect the Ohmmeter from the Sweeper rear panel PEN LIFT terminals.

t. Connect the DC Differential Voltmeter to the Regulated Power Supply.

u. Connect the Sweeper, Attenuator, Crystal Detector and Oscilloscope as shown in figure 4-2. Connect the 0.96 to 4.2 GHz Frequency Meter between the Attenuator and Crystal Detector.

v. Adjust the Regulated Power Supply for a reading of +1 volt on the DC Differential Voltmeter.

w. Connect the DC Differential Voltmeter to Sweeper rear panel REF OUTPUT Connector.

x. Connect the Regulated Power Supply to the Sweeper rear panel EXT CONT VOLTAGES FREQ Connector.

y. Depress the Sweeper EXT FREQ CONT Pushbutton Switch.

z. Observe the indication on the DC Differential Voltmeter; it should be -1 volt ±0.2% of the magnitude of input voltage.

aa. Repeat steps v through y with the Regulated Power Supply adjusted for a reading of +3 volts; the voltage observed in step w should always be a negative voltage equal to the positive voltage setting on the Regulated Power Supply.

ab. Vary the voltage of the Regulated Power Supply from +1 to +4 volts.

ac. Observe the indication on the DC Differential Voltmeter and the Oscilloscope; both the voltage and frequency should increase with the Power Supply increase (the frequency should increase 1 GHz per 1 volt ±0.5%).

ad. Disconnect the 0.96 to 4.2 GHz Frequency Meter and connect the 3.7 to 12.4 GHz Frequency Meter in its place.

ae. Repeat steps v through y with the Regulated Power Supply adjusted for readings of +6, +9 and +12 volts; the voltage observed in step w should always be a negative voltage equal to the positive voltage setting on the Regulated Power Supply.

af. Vary the voltage of the Regulated Power Supply from +4 to +12 volts.

ag. Repeat step ac.

ah. Disconnect the Regulated Power Supply from the Sweeper rear panel EXT CONT VOLTAGES FREQ Connector; connect it to the EXT CONT VOLTAGES AMPLITUDE Connector.

ai. Adjust the Regulated Power Supply to +1 volt.

aj. Rotate the Sweeper RF POWER Control to the full counterclockwise (EXT CONT) position.

ak. Disconnect the DC Differential Voltmeter from Test Point TP203, on the number 200 printed circuit board; connect it to the junction point of resistor R355 and the collector of transistor Q307, on the number 300 printed circuit board.

al. Vary the voltage of the Regulated Power Supply from 0 to +1 volts.

am. Observe the indication on the Voltmeter; it should decrease as the Power Supply decreases and be approximately 2/3 of the input voltage.

4-20. Δ F OPERATION.

a. Remove the extension connector from the Sweeper number 300 printed circuit board and reinsert the board in the Sweeper under test; place Sweeper number 200 printed circuit board on the extension connector and reinsert it in the unit.

b. Depress the Sweeper Δ F and F1 Pushbutton Switches.

c. Connect the Oscilloscope probe to the junction point of relay K801E and resistor R201, on the Sweeper number 200 printed circuit board.

d. Ground the Oscilloscope to the buss bar at the front of the Sweeper under test using a grounding strap.

e. Set the Δ F WIDTH-MHz Switch to the 100 position.

f. Observe the Oscilloscope indication; it should be a DC signal.

g. Disconnect the Oscilloscope probe from the junction of K801E and resistor R201, on the Sweeper number 200 printed circuit board; and connect it to the junction point of relay K802E and resistor R202.

h. Observe the Oscilloscope indication; it should be a sawtooth signal.

i. Set the Sweeper SWEEP TIME (SEC) Lever to the .01-.1 position.

j. Set the Oscilloscope for DC inputs.

k. Rotate the Sweeper Δ F VERNIER Control to the full clockwise (CAL) position.

l. Observe and note the Oscilloscope indication; it should be a sawtooth signal with the peak-to-peak voltage equal to 1 mV per MHz ±5%; the sawtooth must exactly cross the zero reference line within 5 mV of mid sweep time.

m. Rotate the Sweeper Δ F VERNIER Control to the full counterclockwise position.

n. Observe the Oscilloscope indication; it should be a sawtooth signal with the peak-to-peak voltage 10% of that observed in step l.

p. Repeat steps j through n for all switch positions of the Sweeper Δ F WIDTH-MHz Switch.

q. Disconnect the Oscilloscope probe from the junction point of relay K802E and R202; and connect it to Test Point TP105.

r. Depress the Sweeper Δ F Pushbutton Switch.

s. Set the Sweeper SYNC Lever to the MAN SCAN position.

t. Rotate the Sweeper MAN SCAN control to the full clockwise position.

u. Observe the oscilloscope indication; it should be a sawtooth signal with a peak-to-peak voltage of +6.5 volts.

v. Rotate the Sweeper MAN SCAN control to the full counterclockwise position.

w. Observe the oscilloscope indication; it should be a sawtooth signal with a peak-to-peak voltage of -6.5 volts.

x. Remove the extension connector from the Sweeper number 200 printed circuit board and reinsert it in the unit.

4-21. PHASE LOCK CHECK.

a. Connect the Coaxial Adapter and the Power Meter to the Sweeper rear panel RF SAMPLE connector.

b. Set the Sweeper F1 Digital Frequency Selector to 1.000 GHz, the M1 Digital Frequency Selector to 3.000 GHz, the M2 Digital Frequency Selector to 5.000 GHz and the F2 Digital Frequency Selector to 7.000 GHz.

c. Set the Sweeper LEVELER Lever to the INT position.

d. Depress the Sweeper CW and F1 Pushbutton Switches.

e. Observe the Power Meter; it should indicate a minimum of -5dBm.

f. Depress the Sweeper F2 Pushbutton Switch.

g. Observe the Power Meter; it should indicate a minimum of -5dBm.

h. Disconnect the Power Meter from the Coaxial Adapter, and connect the Frequency Counter in its place.

i. Depress the Sweeper M1 Pushbutton Switch.

j. Observe the Frequency Counter; it should indicate 1.500 GHz ±1%.

k. Depress the Sweeper M2 Pushbutton Switch.

l. Observe the Frequency Counter; it should indicate 1.666 GHz ±1%.

m. Disconnect the Frequency Counter.

4-22. ALIGNMENT PROCEDURE.

4-23. INITIAL SETUP. (Refer to figure 4-1.)

a. Set the 115V/230V Slide Switch to the appropriate voltage position.

CAUTION

Ensure the Sweeper's POWER
Switch is in the Off position.

b. Connect the external power cable to the 115V/230V receptacle on the rear panel, and the external power source.

c. Remove the four mounting screws in the Sweeper top cover and remove the cover.

4-24. POWER SUPPLIES.

4-25. VOLTAGE MEASUREMENTS.

a. Set the DC Differential Voltmeter to the 50V, -DC scale.

b. Connect the DC Differential Voltmeter (+) lead to Test Point TP501, on the Sweeper number 500 printed circuit board; connect the common lead to any convenient chassis ground.

c. Set the Sweeper POWER Switch to the On position.

d. Adjust the -22V ADJ potentiometer (R503) on the Sweeper number 500 printed circuit board, for a DC Differential Voltmeter indication of -22 volts ±10 mV.

e. Remove the Differential Voltmeter (+) lead from TP501 and connect the lead to Test Point TP403, on the Sweeper number 400 printed circuit board.

f. Adjust the -15V ADJ potentiometer (R417) on the Sweeper number 400 printed circuit board, for a DC Differential Voltmeter indication of -15 volts ±20 mV.

g. Remove the DC Differential Voltmeter (+) lead from TP403 and connect the lead to Test Point TP401, on the Sweeper number 400 printed circuit board.

h. Adjust the -13V ADJ potentiometer (R424), on the Sweeper number 400 printed circuit board, for a DC Differential Voltmeter indication of -13 volts ±10 mV.

i. Remove the DC Differential Voltmeter (+) lead from TP401.

j. Set the DC Differential Voltmeter to the 10V, -DC scale.

k. Connect the DC Differential Voltmeter (+) lead to terminal Test Point TP503 on the Sweeper number 500 printed circuit board.

l. Adjust the -6V ADJ potentiometer (R515), on the Sweeper number 500 printed circuit board, for a DC Differential Voltmeter indication of -6 volts ±10 mV.

m. Remove the DC Differential Voltmeter (+) lead from Test Point TP503.

n. Set the DC Differential Voltmeter to the 50V, +DC scale.

p. Connect the DC Differential Voltmeter (+) lead to Test Point TP502, on the Sweeper number 500 printed circuit board.

q. Adjust the +28V ADJ potentiometer (R511), on the Sweeper number 500 printed circuit board, for a DC Differential Voltmeter indication of +28 volts ±10 mV.

r. Remove the DC Differential Voltmeter (+) lead from TP502 and connect the lead to Test Point TP402, on the Sweeper number 400 printed circuit board.

s. Adjust the +15V ADJ potentiometer (R405), on the Sweeper number 400 printed circuit board, for a DC Differential Voltmeter indication of +15 volts ±20 mV.

t. Remove the DC Differential Voltmeter (+) lead from TP402 and connect the lead to Test Point TP404, on the Sweeper number 400 printed circuit board.

u. Adjust the +13V ADJ potentiometer (R410), on the Sweeper number 400 printed circuit board, for a DC Differential Voltmeter indication of +13 volts ±10 mV.

v. Remove both DC Differential Voltmeter leads.

4-26. RAMP GENERATOR.

a. Place the number 100 printed circuit board on the extension connector and reinsert the board in the unit under test (refer to figure 4-1).

b. Set the Sweeper controls as follows:

| Control | Setting |
|---|---|
| F1 Digital Frequency Selector | 1.000 |
| M1 Digital Frequency Selector | 3.000 |
| M2 Digital Frequency Selector | 4.000 |
| F2 Digital Frequency Selector | 2.000 |
| SWEEP TIME Lever | .01-.1 |
| SYNC Lever | TRIG |
| MAN SCAN Control | Full counterclockwise |
| VERNIER Control | Full counterclockwise |
| WIDTH-MHz Control | 100 |
| MODULATION | OFF |
| LEVELER Lever | RF OFF |
| AMPLITUDE Control | Full clockwise |
| MARKER Control | Mid rotation position |
| START/STOP Pushbutton Switch | Depressed |
| F1 Pushbutton Switch | Depressed |
| F2 Pushbutton Switch | Depressed |

c. Connect the DC Differential Voltmeter to Test Point TP104, on the Sweeper number 100 printed circuit board.

d. Adjust the PEAK ADJ potentiometer (R136), on the Sweeper number 100 printed circuit board, for a DC Differential Voltmeter indication of 13.000 ±0.01 volts.

e. Disconnect the DC Differential Voltmeter from Test Point TP104, and connect the Oscilloscope probe to TP105.

f. Adjust the Oscilloscope as follows:

| Oscilloscope and Plug-In Control | Position |
|---|---|
| AC-GND-DC Input | GND |
| VOLTS/CM | 100 mV |
| TIME/CM | 20 msec |

g. Adjust the Oscilloscope for a zero reference.

h. Set the Sweeper SYNC Lever to the INT position.

i. Set the AC-GND-DC Input lever on the Oscilloscope plug-in to the DC position.

j. Adjust the ZERO ADJ potentiometer (R131), on the Sweeper number 100 printed circuit board, to place the negative peak of the sawtooth waveform within 100 mV of the zero reference.

NOTE

Due to the drift of the Oscilloscope this step should be repeated several times to ensure best adjustment.

k. Set the Sweeper SYNC Lever to the MAN SCAN position.

l. Disconnect the Oscilloscope leads.

m. Connect the DC Differential Voltmeter to Test Point TP105, on the Sweeper number 100 printed circuit board.

n. Rotate the Sweeper MAN SCAN Control to the full clockwise position.

p. Adjust the INV. PEAK ADJ. potentiometer (R147), on the Sweeper number 100 printed circuit board, for a DC Differential Voltmeter reading of 13.000 ±0.01 volts.

q. Rotate the Sweeper MAN SCAN Control to the full counterclockwise position.

r. Observe the DC Differential Voltmeter indication; it should be within 10 mV of zero.

NOTE

If the DC Differential Voltmeter indication is not proper, proceed with steps t and u.

s. Adjust the INV. ZERO BAL. potentiometer (R141), on the Sweeper number 100 printed circuit board, for a DC Differential Voltmeter reading within 10 mV of zero.

t. Repeat steps p and q.

4-27. SUMMING AMPLIFIER.

a. Remove the extension connector from the Sweeper number 100 printed circuit board and reinsert the board in the unit under test; place the number 200 printed circuit board on the extension connector and reinsert in the unit.

b. Connect the DC Differential Voltmeter to Test Point TP203, on the Sweeper number 200 printed circuit board.

c. Set the Sweeper F1 Digital Frequency Selector to 1.000 GHz, and the F2 Digital Frequency Selector to 12.400 GHz.

d. Set the Sweeper SYNC Lever to the MAN SCAN position.

e. Rotate the Sweeper MAN SCAN Control to the full counterclockwise position.

f. Observe the DC Differential Voltmeter indication; note the difference from an indication of 1.000 volts.

g. Rotate the Sweeper MAN SCAN Control to the full clockwise position.

h. Observe the DC Differential Voltmeter indication; note the difference from an indication of 12.400 volts.

i. The differences observed in steps e and g should be equal ±30 mV.

NOTE

If the differences observed in steps f and h are not equal, proceed with step j. If the differences observed are equal, proceed with step k.

j. Repeat steps e through i, and adjust the INV. PEAK ADJ. potentiometer (R147), on the Sweeper number 100 printed circuit board, until the DC Differential Voltmeter indication noted in steps f and h are equal.

k. Rotate the Sweeper MAN SCAN Control to the full counterclockwise position.

l. Adjust the SUM ZERO BAL. potentiometer (R204), on the Sweeper number 200 printed circuit board; until the error noted in step f has been eliminated or does not exceed ±5 mV.

4-28. MARKER GENERATOR.

a. Connect the Sweeper, Attenuator, Crystal Detector, and Oscilloscope as shown in figure 4-2. Connect the 0.96 to 4.2 GHz Frequency Meter between the Attenuator and Crystal Detector.

b. Set the Sweeper F1 Digital Frequency Selector to 1.000 GHz.

c. Depress the Sweeper Δ F Pushbutton Switch.

d. Rotate the WIDTH MHz-VERNIER Control to the 100 MHz position.

e. Set the Sweeper M1 Digital Frequency Selector to 1.000 GHz, and the M2 Digital Frequency Selector to 2.000 GHz.

f. Adjust the Frequency Meter to 1.000 GHz.

g. Observe the Oscilloscope indication.

h. Adjust the MARKER 1 OFFSET BAL. potentiometer (R214), on the Sweeper number 200 printed circuit board, until the Marker 1 pip Oscilloscope indication is coincidental with the Frequency Meter pip indication observed in step g.

i. Set the Sweeper M1 Digital Frequency Selector to 2.000 GHz, and the M2 Digital Frequency Selector to 1.000 GHz.

j. Adjust the MARKER 2 OFFSET BAL. potentiometer (R222), on the Sweeper number 200 printed circuit board, until the Marker 2 pip Oscilloscope indication is coincidental with the Frequency Meter pip indication observed in step g.

k. Disconnect the 0.96 to 4.2 GHz Frequency Meter and connect the 3.7 to 12.4 GHz Frequency Meter in its place.

l. Set the Sweeper F1 and M1 Digital Frequency Selector to 11.000 GHz, and the M2 Digital Frequency Selector to 12.000 GHz.

m. Adjust the Frequency Meter to 11.000 GHz.

n. Observe the Oscilloscope indication; the indications from the Frequency Meter and the M1 Voltage Divider should be coindidental within 1%.

p. Set the Sweeper M2 Digital Frequency Selector to 11.000 GHz, and the M1 Digital Frequency Selector to 12.000 GHz.

q. Observe the Oscilloscope indication; the indications from the Frequency Meter and the M2 Voltage Divider should be coincidental within 1%.

NOTE

If the results observed in steps n and q are not correct, repeat steps e through q.

r. Disconnect the 3.7 to 12.4 GHz Frequency Meter from the test setup and reconnect as shown in figure 4-2.

s. Set the Sweeper M1 Digital Frequency Selector to 11.03 GHz and M2 Digital Frequency Selector to 11.06 GHz.

t. Rotate the WIDTH MHz-VERNIER Control to the .1 MHz position.

u. Adjust the MARKER WIDTH BAL potentiometer R262, on the Sweeper number 200 printed circuit board, until the amplitude and width of the marker 1 and marker 2 pip oscilloscope indications are equal.

4-29. SWEEP RATE LIMITER.

a. Set the Sweeper F1 Digital Frequency Selector to 1.000 GHz and the F2 Digital Frequency Selector to 2.000 GHz.

b. Depress the Sweeper START/STOP Pushbutton Switch.

c. Set the Sweeper SWEEP TIME (SEC) Lever to the .01 position.

d. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp does not light.

NOTE

If the SWEEP TIME (SEC) X10 Indicator Lamp lights, proceed with step r.

e. Increase the frequency indication on the Sweeper F2 Digital Frequency Selector 3 GHz to read 5.000 GHz.

f. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp lights.

NOTE

If the SWEEP TIME (SEC) X10 Indicator Lamp does not light, proceed with step r.

g. Increase the frequency indication on the Sweeper F1 Digital Frequency Selector 3 GHz to read 4.000 GHz.

h. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp does not light.

NOTE

If the SWEEP TIME (SEC) X10 Indicator Lamp lights, proceed with step r.

i. Repeat steps e through f increasing the Sweeper F1 and F2 Digital Frequency Selectors 3 GHz until F1 indicates 10.000 GHz and F2 indicates 11.000 GHz.

j. Set the Sweeper F1 Digital Frequency Selector to 12.000 GHz and the F2 Digital Frequency Selector to 11.000 GHz.

k. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp does not light.

NOTE

If the SWEEP TIME (SEC) X10 Indicator Lamp lights, proceed with step r.

l. Decrease the frequency indication on the Sweeper F2 Digital Frequency Selector 3 GHz to read 8.000 GHz.

m. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp lights.

NOTE

If the SWEEP TIME (SEC) X10 Indicator Lamp does not light, proceed with step r.

n. Decrease the frequency indication on the Sweeper F1 Digital Frequency Selector 3 GHz to read 9.000 GHz.

p. Observe that the Sweeper SWEEP TIME (SEC) X10 Indicator Lamp does not light.

NOTE

If the SWEEP TIME (SEC) X10 Indicator Lamp lights, proceed with step r.

q. Repeat steps j through m decreasing the Sweeper F1 and F2 Digital Frequency Selectors 3 GHz until F2 indicates 2.000 GHz and F1 indicates 3.000 GHz.

r. Adjust the AUTO. MULT. TRIG. LEVEL potentiometer (R252), on the Sweeper number 200 printed circuit board, until the proper SWEEP TIME (SEC) X10 Indicator Lamp indication is obtained.

NOTE

When the proper adjustment has been obtained, repeat the step where the improper Indicator Lamp operation was noted, and continue with the procedure.

4-30. BLANKING PULSE.

a. Set the Sweeper SYNC Lever to the TRIG position.

b. Connect the DC Differential Voltmeter to the arm of the BLANKING ZERO BAL. potentiometer (R240), on the Sweeper number 200 printed circuit board.

c. Adjust the BLANKING ZERO BAL. potentiometer (R240), on the Sweeper number 200 printed circuit board, for a zero volt indication on the DC Differential Voltmeter.

d. Set the Sweeper RETRACE RF Slide Switch to the BLANK position.

e. Observe the Voltmeter indication; it should be > -2 volts.

4-31. MODULATION CIRCUITS.

a. Place the Fast Rise Preamplifier Plug-In unit in the Oscilloscope and connect the X10 probe.

b. Remove the extension connector from the Sweeper number 200 printed circuit board and reinsert the board in the Sweeper under test; place the Sweeper number 300 printed circuit board on the extension connector and reinsert in the unit.

c. Depress the CW and F1 Pushbutton Switches.

d. Connect the Oscilloscope probe to Test Point TP302, on the Sweeper number 300 printed circuit board.

e. Adjust the LEV. SUM AMPL. BAL. potentiometer (R324), on the Sweeper number 300 printed circuit board, for a -2 volt DC Oscilloscope indication.

f. Set the Sweeper MODULATION Lever to the ⊔⊓ position.

g. Observe the Oscilloscope indication; it should be a 3 volt peak-to-peak square wave.

h. Adjust the PEAK MODULATION LEV. potentiometer (R315), on the Sweeper number 300 printed circuit board, so that the negative peaks of the square wave is exactly at -2 volts.

i. Connect the Sweeper, Attenuator, Crystal Detector and Oscilloscope as shown in figure 4-2.

j. Set the Sweeper LEVELER Lever to the EXT position.

NOTE

If the Model 9500 Option 01 is incorporated in the unit under test, reference to the Sweeper LEVELER Lever EXT position should be changed to the INT position.

k. Adjust the Oscilloscope for a two cycle square wave indication.

l. Adjust variable capacitor C304, on the Sweeper number 300 printed circuit board, to compensate the circuit for a minimum overshoot and rise time.

m. Set the MODULATION Lever to the OFF position.

n. Disconnect the Attenuator from the Sweeper RF OUTPUT Connector and connect the Power Meter to the RF OUTPUT Connector.

p. Adjust the RF POWER Control for a 1 mW indication on the Power Meter.

q. Disconnect the Power Meter from the Sweeper RF OUTPUT Connector and reconnect, as shown in figure 4-2.

r. Adjust the Sweeper 800-1200 Hz Control for an Oscilloscope square wave period of 1 msec.

s. Adjust the SYM potentiometer (R336), on the Sweeper number 300 printed circuit board, for the proper symmetry of the Oscilloscope square wave indication.

t. Rotate the Sweeper 800-1200 Hz Control to the full counterclockwise position.

u. Observe the Oscilloscope indication; it should be a square wave period of greater than 1.25 msec (less than 800 Hz).

v. Rotate the Sweeper 800-1200 Hz Control to the full clockwise position.

w. Observe the Oscilloscope indication; it should be a square wave period of less than 830 $\mu$sec. (greater than 1200 Hz).

x. Set the Sweeper MODULATION Lever to the EXT AM position.

y. Connect the Pulse Generator to the Sweeper EXT MOD Connector.

z. Adjust the Pulse Generator for a 1.0 $\mu$sec pulse width and sufficient duty cycle to obtain a convenient Oscilloscope indication.

aa. Adjust the Pulse Generator output (starting at zero volt) for a good Oscilloscope reproduction of the input shape.

ab. Connect the Oscilloscope to the Sweeper EXT MOD Connector using "Tee" connector.

ac. Observe the Oscilloscope indication; the amplitude should be less than 15 volts peak.

ad. Set the Sweeper MODULATION Lever to the OFF position.

4-32. LEVELER.

a. Connect the Sweeper, Coupler, Attenuator, Crystal Detector and Oscilloscope as shown in figure 4-3.

NOTE

If the Model 9500 Option 01 is incorporated in the unit under test, the external 16dB Coupler is not required in the test setup and all reference to the Sweeper LEVELER Lever EXT position should be changed to the INT position.

b. Set the Sweeper F1 Digital Frequency Selector to 1.000 GHz and the F2 Digital Frequency Selector to 12.4 GHz.

c. Depress the START/STOP, F1 and F2 Pushbutton Switches.

d. Set the Sweeper LEVELER Lever to the EXT position.

e. Observe the Oscilloscope indication; it should be a leveled RF signal from 1.000 to 12.400 GHz.

f. Rotate the LEV. STAB potentiometer (R351), on the Sweeper number 300 printed circuit board, to the full clockwise position.

g. Slowly rotate the Sweeper RF POWER Control from the full counterclockwise to the full clockwise position, while observing the Oscilloscope indication.

h. At points where oscillation is observed on the Oscilloscope, slowly rotate the LEV. STAB potentiometer (R351), on the Sweeper number 300 printed circuit board, counterclockwise until the oscillations are eliminated.

i. Rotate the RF POWER Control until Oscilloscope indication is observed.

j. Rotate the Sweeper LEV. BAL. potentiometer (R341), on the Sweeper number 300 printed circuit board, to the full counterclockwise position.

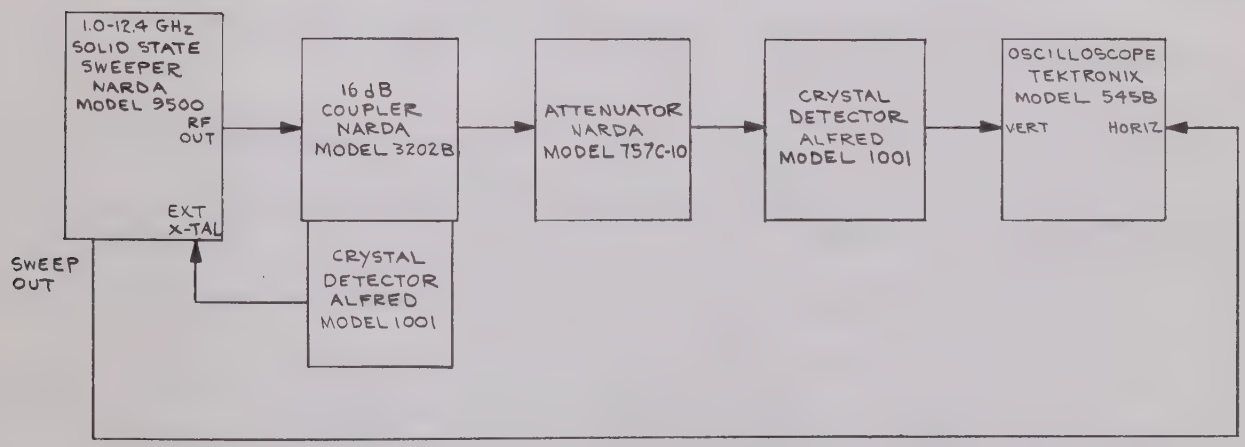



Figure 4-3. Leveler Alignment Test Setup

k. Observe the Oscilloscope indication; it should be a partially blank signal.

l. Slowly rotate the Sweeper LEV. BAL. potentiometer (R341), on the Sweeper number 300 printed circuit board, clockwise until a blank signal is observed on the Oscilloscope.

m. Disconnect the unit under test from the test setup.

4-33. METER CALIBRATION. (For units containing Option 01, Internal Levelling.)

NOTE

When operating the Model 9500 in the leveled condition over-saturation of the Leveler (Internal or External) may cause the meter indication to backoff (read lower) and the UNLEVELED indicator light to come on.

a. Connect the Power Meter to the Sweeper RF OUTPUT Connector.

b. Depress the CW Pushbutton Switch.

c. Adjust the Sweeper RF POWER Control for an indication of 0dB (1mW) on the Power Meter.

d. Adjust the MTR BAL. potentiometer (R387), on the Sweeper number 300 printed circuit board, for an indication of 0dBm on the Sweeper POWER DBM Meter.

e. Adjust the Sweeper RF POWER Control on the Sweeper for an indication of +10dBm (10mW) on the Power Meter.

f. Adjust the MTR CAL. potentiometer (R389), on the Sweeper number 300 printed circuit board, for an indication of +10dBm on the Sweeper POWER DBM Meter.

g. Repeat steps a through f until both the 0 and +10dBm readings are within ±1dB of their respective setings.

4-34. METER CALIBRATION. (For units not containing Option 01, Internal Levelling.)

NOTE

When operating the Model 9500 in the leveled condition, over-saturation of the Leveler (Internal or External) may cause the meter indication to backoff (read lower) and the UNLEVELED indicator light to come on.

a. Connect the Sweeper, Directional Coupler and Power Meter as shown in Figure 4-4.

b. Set the Sweeper M1 Digital Frequency Selector Switch to 4.000 GHz.

c. Depress the CW and M1 Pushbutton Switches.

d. Adjust the Sweeper RF POWER Control for an indication of 0dB (1mW) on the Power Meter.

e. Adjust the MTR BAL. potentiometer (R387), on the Sweeper number 300 printed circuit board, for an indication of 0dBm on the Sweeper POWER DBM Meter.

f. Adjust the Sweeper RF POWER Control on the Sweeper for an indication of +10 dBm (10mW) on the Power Meter.

g. Adjust the MTR CAL. potentiometer (R389), on the Sweeper number 300 printed circuit board, for an indication of +10dBm on the Sweeper POWER DBM Meter.

h. Repeat steps a through f until both the 0 and +10dBm readings are within ±1dB of their respective setting.

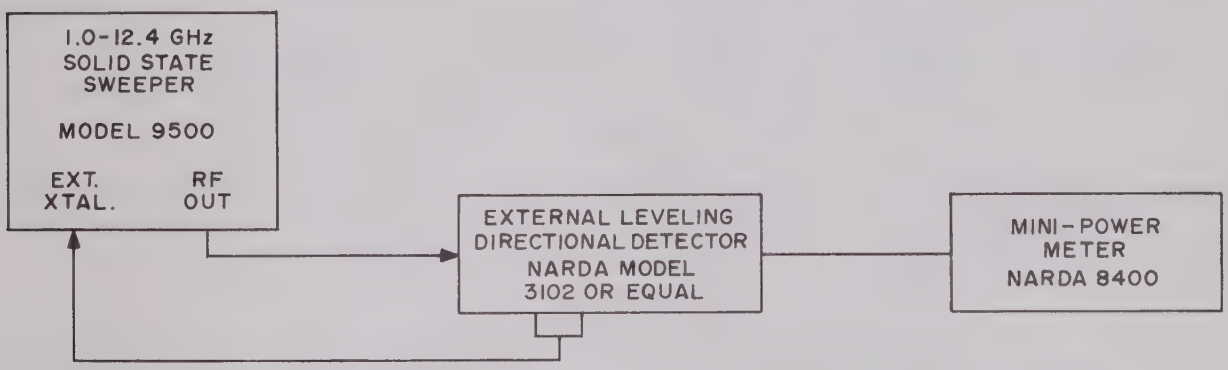



Figure 4-4. POWER DBM Meter Calibration Test Setup.

4-35. Δ F OPERATION.

a. Remove the extension connector from the Sweeper number 300 printed circuit board and reinsert the board in the Sweeper under test, place Sweeper number 200 printed circuit board on the extension connector; reinsert it in the unit.

b. Depress the Sweeper Δ F and F1 Pushbutton Switches.

c. Connect the Oscilloscope probe to the junction point of relay K801E and resistor R201, on the Sweeper number 200 printed circuit board.

d. Ground the Oscilloscope to the buss bar at the front of the Sweeper under test, using a grounding strap.

e. Set the Δ F WIDTH-MHz Switch to the 100 position.

f. Observe the Oscilloscope indication; it should be a DC signal.

## 4-36. TROUBLESHOOTING.

4-37. Troubleshooting can be performed by using the data provided in table 4-1 through table 4-6. In addition, when troubleshooting use the General Theory of Operation provided in Section III, and the Schematic Diagrams provided in Section VI of this manual. Table 4-1 covers the +28 Volt Delayed Power Supply. Table 4-2 covers the -22 Volt Power Supply. Table 4-3 covers both the -15 Volt and -13 Volt Power Supplies because they use the same components. Table 4-4 covers +15 Volt Power Supplies. Table 4-5 covers the -6 Volt Power Supply. Check or troubleshoot the power supplies before proceeding to other circuits. Table 4-6 is the general system troubleshooting of all the circuits except for the power supplies.

4-38. When troubleshooting the Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/ SIGNAL GENERATOR it is recommended that the procedures be followed in the exact sequence as listed in table 4-5. These procedures were designed to isolate any malfunctions in the minimum time and with the least number of actual voltage or waveshape measurements. These procedures are all based on a fault indication observed during normal operation of the equipment. Each new step in the troubleshooting table assumes that all previous procedures have checked out and therefore the circuits that were exercised are operating properly. Refer to the Schematic Diagrams in Section VI to isolate the associated circuits.

NOTE

The troubleshooting method to be used when high frequency oscillations are being generated is to probe the suspected stage with an oscilloscope. The stage or point where the greatest peak-to-peak oscillations occur is the stage where the oscillations are being generated.

## 4-39. PRINTED CIRCUIT BOARDS.

4-40. REPAIR. Printed circuit damage generally is confined to separation or fusion of the copper foil. The following procedure is recommended for repairing this type of damage.

a. Carefully remove the separated copper foil with tweezers.

b. Drill a small hole through the board at the ends of the conductors on each side of the remaining gap.

c. Make parallel right angle bends in a piece of tinned hookup wire at points separated by the same distance as the two holes.

d. Clean the area around the holes with varnish remover and wipe with isopropyl alcohol.

e. When dry, apply liquid flux to the area.

f. Insert the hookup wire through the drilled holes.

g. Solder hookup wire in place.

h. Clip off extra length of wire flush with reverse side of the board, using crimping end cutters.

i. Spray area with varnish.

Table 4-1

+28V DELAYED SUPPLY

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No +28 volt supply | +28v supply 500 board | TP502 | a. IC502, Q1, Q506 defective<br>b. CR506 defective<br>c. Short within unit causing S11 to trip out.<br>d. Defective F1101 |
| Excessive ripple on +28v supply | +28v supply 500 board | TP502 | a. C9, C506 defective<br>b. CR506 reference diode noisy |
| High frequency oscillation on +28v supply | +28v supply 500 board | TP502 | a. Replace IC502, C509 defective<br>b. Compensation capacitors C507 and C508 defective<br>c. Oscillation being generated by another IC being fed by +28v supply |
| No +28 volts delayed | Delayed +28 volts 500 board | TB1002 #6 bottom R. F. plate | a. No +28v from basic supply<br>b. Q3 defective<br>c. K3C defective |

Table 4-2

-22 VOLT POWER SUPPLY

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No -22 volt supply | -22v supply 500 board | TP501 | a. No +15v supply<br>b. No -15v supply<br>c. No +13v supply<br>d. IC501, Q502, Q501 defective<br>e. CR501 defective |
| Excessive ripple on +15 volt supply | -22v supply 500 board | TP501 | a. C501 defective<br>b. +13v supply has excessive ripple |
| High frequency oscillation on -22v supply | -22v supply 500 board | TP501 | a. Replace IC501, C504 defective<br>b. Compensation capacitors C502 and C503 defective<br>c. Oscillation being generated by another circuit |

Table 4-3

-15 VOLT AND -13 VOLT POWER SUPPLIES

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No -15 volt supply | -15v supply 400 board | TP403 | a. No +15v supply<br>b. IC403, Q405, Q406 defective<br>c. CR410 reference diode, CR406 defective, or associated circuitry |
| Excessive ripple on -15 volt supply | -15v supply 400 board | TP403 | a. C409, C410 defective<br>b. CR410 reference diode noisy |
| High frequency oscillation on -15v supply | -15v supply 400 board | TP403 | a. Replace IC403, C413 defective<br>b. Compensation capacitors C411, C412 defective<br>c. Oscillation being generated by another circuit |
| No -13 volt supply | -13v supply 400 board | TP401 | a. No +15v supply<br>b. No -15v supply<br>c. IC402, Q408 defective<br>d. CR411 open or associated circuitry |
| High frequency oscillation on -13v supply | -13v supply 400 board | TP401 | a. Replace IC402, C416 defective<br>b. Compensation capacitors C414, C415 defective<br>c. Oscillation being generated by another circuit |

Table 4-4

+15 VOLT AND +13 VOLT POWER SUPPLIES

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No +15 volt supply | +15v supply 400 board | TP402 | a. No +28v supply<br>b. IC401, Q401, Q402 defective<br>c. CR405 reference diode, CR401 defective, CR4 shorted<br>d. Or associated circuitry |
| Excessive ripple on +15 volt supply | +15v supply 400 board | TP402 | a. C401 defective<br>b. CR405 reference diode |
| High frequency oscillation on +15v supply | +15v supply 400 board | TP402 | a. Replace IC401, C405 defective<br>b. Compensation capacitors C404, C403 defective<br>c. Oscillation being generated by another IC being fed by +15 volt supply |

Table 4-4 (Cont)

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No +13 volt supply | +13v supply 400 board | TP404 | a. No +15 volt supply<br>b. No +28 volt supply<br>c. IC402, Q404 defective or associated circuitry |
| High frequency oscillation on +13v supply | +13v supply 400 board | TP401 | a. Replace IC402<br>b. Compensation capacitors C406, C407 defective<br>c. Oscillation being generated by another circuit |

Table 4-5

-6 VOLT POWER SUPPLY

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No -6 volt supply | -6v supply 500 board | TP503 | a. No +15 volt supply<br>b. No -15 volt supply<br>c. IC503, Q2, Q507, CR15 defective<br>d. R44 open<br>e. CR510 defective<br>f. And associated circuitry |
| Excessive ripple on -6 volt supply | -6v supply 500 board | TP503 | a. C13 defective<br>b. CR510 reference diode noisy |
| High frequency oscillation on -6v supply | -6v supply 500 board | TP503 | a. Replace IC503, C512<br>b. Compensation capacitors C510, C511 defective<br>c. Oscillations being generated by another circuit |

Table 4-6

OVERALL TROUBLESHOOTING

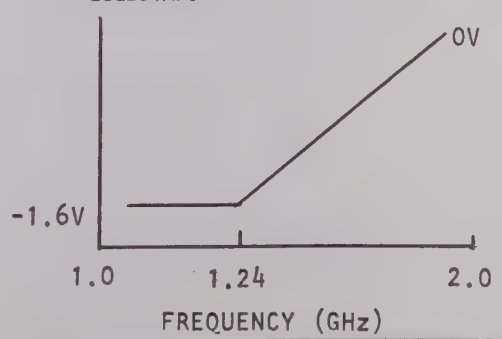
| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No R. F. output | No output L-Band Amp. Q1005, Q1001, Q1002 | Output of Hybrid (307809) | a. +28 volt supply (TP502)<br>b. Delayed +28 volt supply (TB1002, Pin 6)<br>c. -6 volt supply (TP503)<br>d. Q1005, Q1001, Q1002 defective |
| | No output L-Band oscillator (86902000) | Terminated port of isolator (8690300) | a. -22 volt supply (TP501)<br>b. Oscillator controller IC702 (TP706) and associated circuitry<br>c. Oscillator driver Q7, Q8<br>d. L-Band osc. defective<br>e. 2 volt shifter IC701 (TP705) and associated circuitry |
| Erratic R. F. output from 1.0-12.4 GHz | Direction coupler | Output connector | a. Intermittent mechanical contact |
| No R. F. output from 2.0-12.4 GHz (R. F. from 1.0 to 2.0 is available) | No output multiplier (86901000) | R. F. output of multiplier | a. No bias ramp (J603)<br>1. IC603 and IC602 and associated circuitry<br>b. Multiplier controller IC601 and associated circuitry<br>c. Multiplier driver Q4, Q5<br>d. Multiplier defective |
| No R. F. output from 8.0 to 12.4 GHz | Multiplier linearizers | Cathodes of CR614, CR611, CR612, CR613 | a. Diodes CR614, CR611, CR612, CR613<br>b. Potentiometers R605, R607, R611, R613 |
| Spurs throughout 2.0 to 12.4 GHz Band | Incorrect bias ramp | J603 | a. Defective IC603 or IC602<br>b. Requires re-calibration<br>1. Monitor ramp at J603<br>2. Adjust R673 and R672 for a ramp as follows:<br>  <br> |

Table 4-6 (Cont)

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| Oscillation throughout Band in the Leveled condition | Leveler amplifier | TP303 | a. Defective IC302, C319, C316 or associated circuitry<br>b. Requires re-calibration<br>1. Adjust R351 leveler stability |
| No control of R. F. output | Leveler amplifier | TP303 | a. Defective IC302 or associated circuitry |
| | Detector and directional coupler | Detector output (PCB1 #36) | a. Defective pin diode module within combiner |
| Internal leveling greater than ±1db from 1.0 to 12.4 GHz | Detector and directional coupler | Detector output (PCB1 #36) | a. Coupler or detector defective |
| No control of R. F. output | Combiner (204059) | | a. Defective pin diode module within combiner |
| L-Band frequency present throughout 2.0-12.4 GHz Band | L-Band switch control | R1107 | a. Q1101, R1106 defective or associated circuitry |
| | L-Band coupler (102716) | | a. Defective pin diode within coupler<br>b. Mechanical breakdown |
| 2nd Harmonic content >30db in L-Band region | Filter (203964) | | a. Diode failure within filter<br>b. Mechanical breakdown |
| | Filter driving circuits | Junction R1138 and R1139 | a. IC1102, Q1105 defective or associated circuitry |
| No sweep | Low limit detector | Junction R155 and R135 | a. IC103 defective or associated circuitry |
| | High limit detector | Cathode of CR109 | a. IC101, CR109 defective or associated circuitry |
| Front panel pushbuttons inoperative | +28v supply | TP502 | a. Q1 transistor defective or associated circuitry |
| | Q801 or Q802 | | a. Q801 or Q802 defective |

Table 4-6 (Cont)

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No sweep | Miller integrator IC102 | TP101 | a. IC102 defective<br>b. R124, R12 open |
| | Binary control amplifiers Q102, Q105 | TP103 | a. Q102, Q105 or associated circuitry |
| | Integrator switch Q104 | TP102 | a. Q104 or associated circuitry |
| | Switch time dwell multi-vibrators Q605, Q607 | TP603 | a. Q605, Q607 or associated circuitry |
| No R. F. sweep | Sum and inverting amplifier IC201 | TP203 | a. IC201 defective or associated circuitry |
| No sweep in any one position of the sweep time switch | Timing capacitors | TP101 | a. C5, C6, C7 or C8 defective<br>b. S1-1A defective |
| Δ F mode inoperative | K803 relay | K803 | a. Defective relay |
| | Δ F tuner assembly | Junction of R32 and R33 | a. R25, R27 defective or associated circuitry |
| *External frequency control mode in-operative | Relay K801 | TP203 | a. Defective relay |
| | Differential amplifier IC203 | TP203 | a. IC203 defective or associated circuitry |
| CW Mode inoperative | Relay K804 | K804 | a. Defective relay |

* Check internal control. If internal operates properly, IC203 is not defective.

Table 4-6 (Cont)

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| One tuner F1, M1, M2 or F2 inoperative in CW mode | Relays:<br>F1=K805 / K809<br>M1=K806<br>M2=K807 / K808<br>F2=K810 | Relay | a. Defective relay |
| | Voltage Followers | F1=TP908<br>M1=TP906<br>M2=TP904<br>F2=TP902 | a. Defective integrated circuits:<br>F1 = IC904<br>M1= IC903<br>M2= IC902<br>F2 = IC901<br>or associated circuitry |
| | Tuner attenuator | Arm of pot. on each tuner | a. Component within tuner defective, replace |
| Line synchronization inoperative | Synchronization shaping circuits | Junction R5 and C1 | a. CR1 shorted<br>b. R2 open or associated components defective |
| | S2-1B #5 switch | | a. Defective switch |
| No trigger synchronization | Trigger associated components | Resistor R10 | a. S7 defective<br>b. R10 open |
| | S2-1B #6 switch | | a. Defective switch |
| Man scan inoperative | Man scan potentiometer | | a. Defective potentiometer (R13) |
| High residual F.M. in C.W. mode | C1001 and K1001 | R1001 sense resistor | a. C1001 leaky<br>b. K1001 defective |
| | -22v supply | TP501 | a. C501 or C504 defective causing excessive ripple |

Table 4-6 (Cont)

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No external modulation | Modulation swimming amplifier IC301 | TP302 | a. IC301, R310 or associated circuitry |
| | Clipping circuit 300 board | Junction R14 and C15 | a. CR2, CR3, R14 defective or associated components |
| | S4-1B #11 switch | Switch | a. Defective switch |
| | Schmidt trigger Q301/Q302 | TP301 | a. Q301 or Q302 defective or associated circuitry |
| No square wave modulation | Square wave generators Q301/Q305 | Junction R327 and R326 | a. Q305, Q304, Q303 or associated circuitry |
| | S4-1A #5 switch | TP301 | a. Q301, Q302 defective or associated circuitry |
| | | Switch | a. Defective switch |
| | Modulation summing amplifier IC301 | TP302 | a. IC301, R310 or associated circuitry |
| Sweep indicator inoperative | Sweep light indicating circuitry | Junction R18 and DS4 | a. DS4, R18, K2 or S1-1B defective |
| No horz sweep output | Sweep out amplifier | J1 or J6 | a. Q106 defective or associated circuitry |
| No blanking on R. F. retrace | Retrace blanking amplifier | Arm of R204 blanking zero balance | a. Q201 defective, R204 open or associated circuitry |
| | S3 retrace R. F. | CR9 cathode | a. CR9 open<br>b. S3 defective |
| | Modulation summing amplifier | TP302 | a. R309 open, IC301 defective or associated circuitry |
| No video blanking pulse output | Video retrace blanking circuitry | J7 rear panel | a. Q503, Q504 defective or associated circuitry |

Table 4-6 (Cont)

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| Pen lift inoperative | K2 relay | J8 rear panel | a. K2 relay defective |
| Sweep count down (X10) circuitry inoperative | Sweep rate limiter circuitry | Collector Q203 and D32 X10 indicator | a. IC206 difference amp, Q202 phase splitter, IC207, Q203 defective, or associated circuitry |
| Sweep count down inoperative with one tuner attenuator | Relay on 800 board | Relay | a. Relay defective -<br>F1 = K805<br>M1= K805 or K806<br>M2= K807 or K808<br>F2 = K807 or K808 |
| Unleveled light not indicating leveling | Unleveled detector circuitry | R339 | a. IC304, Q306, DS3, CR313 or associated circuitry |
| Power meter not indicating | Meter amplifier | R388 | a. IC303, R388, M1 defective or associated circuitry |
| Video intensity of switch point missing and R. F. holds after each switch point | Switch point comparators | Q607 | a. Q605, Q606, Q607 or associated circuitry |
| No switch points throughout band | Switch point comparator circuitry | R753 | a. R753 open<br>b. No ±15v supply on comparators |
| Spurs and breakup in one harmonic | Multiple bias circuitry | TB1001 #7 | a. Harmonic 2nd = Q603, R617<br>3rd = Q602, Q610, R616<br>5 th = Q601, Q609, R615<br>7 th = Q608, R614, R639 or associated circuitry |
| No R. F. sweep in Δ F position | Phase inverter IC104 | TP105 | a. IC104, R147 defective or associated circuitry |
| | K803 relay | | a. Defective relay |

Table 4-6 (Cont)

| SYMPTOM | TROUBLE | TEST POINT | CAUSE |
|---|---|---|---|
| No -6 volt supply | -6v supply 500 board | TP503 | a. No +15v supply<br>b. No -15v supply<br>c. IC503, Q2, Q507, CR15 defective<br>d. R44 open<br>e. CR510 defective<br>f. And associated circuitry |
| Excessive ripple on -6 volt supply | -6v supply 500 board | TP503 | a. C13 defective<br>b. CR510 reference diode |
| High frequency oscillation on -6 volt supply | -6v supply 500 board | TP503 | a. Replace IC503, C512<br>b. Compensation. Capacitors C510, C511 defective<br>c. Oscillations being generated by another circuit |

4-41. COMPONENT REPLACEMENT.

CAUTION

Care must be exercised in replacing components mounted on printed circuit boards to prevent damage to other components and the board.

a. Using round-nose pliers, grasp in turn each lead of the component to be removed, apply well tinned soldering iron until solder is melted, and remove the lead from the mounting holes.

b. Melt solder in area around and over each hole in turn, insert aluminum wire or toothpick into hole, and remove soldering iron immediately. When solder resolidifies, remove wire or toothpick.

c. Replace the component as specified in paragraph 4-40 steps c through j.

# SECTION V

# REPLACEABLE PARTS LIST

## 5-1. GENERAL.

5-2. This section provides a complete listing of the replaceable parts of this unit. The listing contains the necessary ordering information. Parts are listed in alpha-numerical order by reference designator. Complete descriptions of each component are provided in addition to the manufacturer's code and Narda part number in order to facilitate ordering of replacement parts. (See tables 5-1 and 5-2.)

## 5-3. ORDERING INFORMATION.

5-4. If it is desired to order replacement parts from the instrument manufacturer, address the order to:

SALES DEPARTMENT
The Narda Microwave Corporation
Plainview, New York 11803

5-5. When ordering a part in this manner, the following information should be provided:

a. Model and serial number of the instrument.
b. Narda part number.
c. Reference designation.
d. Description.

5-6. When ordering components or parts not listed in table 5-2, a complete description of the part, including its function and location should be provided with the model and serial number of the instrument.

## 5-7. CUSTOMER REPAIR SERVICE.

5-8. Repairs or recalibration of Narda Products are performed by the Customer Service Department at the factory; however, before returning any unit, contact the Narda Microwave Corporation or the local Narda Sales Representative in your area for shipping instructions. When requesting maintenance, complete the form provided at the rear of this manual.

Table 5-1
Manufacturer's Code

| Manufacturer's Supply Code | Name | Address |
|---|---|---|
| 01121 | Allen Bradley Co. | Milwaukee, Wisc. |
| 02660 | Amphenol Corp. | Broadview, Ill. |
| 02735 | RCA, Semiconductor and Material Division | Somerville, N.J. |
| 04713 | Motorola Semiconductor Products Division | Phoenix, Ariz. |
| 05397 | Kemet Div. of Union Carbide Electric | New York, N.Y. |
| 07263 | Fairchild Camera and Instrument Corp. | Mountain View, Calif. |
| 07716 | IRC, Inc. | Burlington, Iowa |
| 56289 | Sprague Electric Co. | North Adams, Mass. |
| 11236 | CTS of Berne, Inc. | Berne, Indiana |
| 11502 | International Resistance Co. | Boone, N.C. |
| 12954 | Dickson Electronics Corp. | Scottsdale, Ariz. |
| 12965 | Computer Components, Inc. | Jamaica, N.Y. |
| 13327 | Solitron Devices, Inc. | Northville, N.J. |
| 14604 | Elmwood Sensors, Inc. | Cranston, R.I. |
| 14655 | Cornell-Dubilier Elec. Corp. | Newark, N.J. |
| 15605 | Cutler-Hammer, Inc. | Milwaukee, Wisc. |
| 18324 | Signetics Corp. | Sunnyvale, Calif. |
| 24223 | Vamistor Corp. | Cedar Knolls, N.J. |
| 30983 | Electra/Midland Corp. Potentiometer Div. | San Diego, Calif. |
| 31433 | Union Carbide Corp. Electronics Div. Components Dept. | Greenville, S.C. |
| 44655 | Ohmite Mfg. Co. | Skokie, Ill. |
| 70309 | Allied Control | New York, N.Y. |
| 71450 | CTS Corp. | Elkhart, Indiana |
| 72136 | The Electro Motive Mfg. Co., Inc. | Willimatic, Conn. |
| 72619 | Dialight Corp. | Brooklyn, N.Y. |
| 72982 | Erie Technological Prod., Inc. | Erie, Pa. |
| 73445 | Amperex Electronic Corp. | Hicksville, N.Y. |

Table 5-1 (Cont)

| Manufacturer's Supply Code | Name | Address |
|---|---|---|
| 75042 | International Resistance Co. | Phila, Pa. |
| 75382 | Kulka Electric Corp. | Mount Vernon, N.Y. |
| 75915 | Littlefuse, Inc. | Des Plaines, Ill. |
| 76493 | J. W. Miller Co. | Los Angeles, Calif. |
| 80031 | Mepco Div. of Sessions Clock Co. | Morristown, N.J. |
| 80294 | Bourns, Ins. | Riverside, Calif. |
| 81030 | International Instruments Inc. | Orange, Conn. |
| 81312 | Winchester Electronics Div. Litton Industries | Oakville, Conn. |
| 81483 | International Rectifier Corp. | El Sequndo, Calif. |
| 82142 | Jeffers Electric Div. of Spear Carbon Company | Du Bois, Pa. |
| 82349 | Switchcraft, Inc. | Chicago, Ill. |
| 83008 | Staco, Inc. | Dayton, Ohio |
| 83330 | Herman H. Smith, Inc. | Brooklyn, N.Y. |
| 87930 | Tower Manufacturing | Providence, R.I. |
| 90291 | Mallory Capacitor Co. | Indianapolis, Ind. |
| 91836 | Kings Electronic Co., Inc. | Tuckahoe, N.Y. |
| 95146 | Alco Electronic Products | Lawrence, Mass. |
| 95275 | Vitramon, Inc. | Bridgeport, Conn. |
| 99899 | Narda Microwave Corp. | Plainview, N.Y. |

## TABLE 5-2. REPLACEABLE PARTS LIST

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| C1 | CAPACITOR,1.0UF,50VDCW | 05397 | K1W50K | 80167082 |
| C2 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C3 | CAPACITOR,330PF,500VDCW | 72136 | DM15F331J0500WV4CR | 80115039 |
| C4 | CAPACITOR,3.3UF,25VDCW | 95397 | K3R3W25K | 80167064 |
| C5 | CAPACITOR,.10UF,50VDCW | 05397 | KR1W50K | 80167076 |
| C6 | CAPACITOR,1.0UF,50VDCW | 05397 | K1W50K | 80167082 |
| C7 | CAPACITOR,10UF,50VDCW | 14655 | TX65BJ100KP | 80181001 |
| C8 | CAPACITOR,100UF,30VDCW | 14655 | CL65BH101KP | 80181002 |
| C9 | CAPACITOR,4500UF,50VDCW | 90201 | CG452U50D1 | 80169001 |
| C10 | CAPACITOR,.001UF,500VDCW | 14655 | BYA10D1 | 80128001 |
| C11 | CAPACITOR,.001UF,500VDCW | 14655 | BYA10D1 | 80128001 |
| C12 | CAPACITOR,10UF,35VDCW | 12954 | D10GC35K | 80168067 |
| C13 | CAPACITOR,2500UF,15VDCW | 90201 | CG252U15A1 | 80169002 |
| C14 | NOT USED | | | |
| C15 | CAPACITOR,100PF,500VDCW | 72136 | DM15E101J0500WV4CR | 80115027 |
| C16 | CAPACITOR,.1UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C101 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C102 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C103 | CAPACITOR,39PF,500VDCW | 72136 | DM15E390J0500WV4CR | 80115019 |
| C104 | CAPACITOR,39PF,500VDCW | 72136 | DM15E390J0500WV4CR | 80115019 |
| C105 | NOT USED | | | |
| C106 | NOT USED | | | |
| C107 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C108 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C109 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C110 | NOT USED | | | |
| C111 | NOT USED | | | |
| C112 | CAPACITOR,330PF,500VDCW | 72136 | DM15E331J0500WV4CR | 80115039 |
| C113 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C201 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C202 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| C203 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C204 | CAPACITOR,2200PF,500VDCW | 72136 | DM19E220J0500WV4CR | 80115058 |
| C205 | CAPACITOR,100PF,500VDCW | 72136 | DM15E101J0500WV4CR | 80115027 |
| C206 | CAPACITOR,2200PF,500VDCW | 72136 | DM19E220J0500WV4CR | 80115058 |
| C207 | CAPACITOR,100PF,500VDCW | 72136 | DM15E101J0500WV4CR | 80115027 |
| C208 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C209 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C210 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C211 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C212 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C213 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C214 | NOT USED | | | |
| C215 | NOT USED | | | |
| C216 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C217 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C301 | CAPACITOR,150PF,500VDCW | 72136 | DM15E131J0500WV4CR | 80115031 |
| C302 | CAPACITOR,.47UF,50VDCW | 12954 | DR47GA50K | 80168070 |
| C303 | CAPACITOR,15PF,500VDCW | 72136 | DM15C150J0500WV4CR | 80115010 |
| C304 | CAPACITOR,3-15PF,VARIABLE | 72982 | 538-011F2P0110R | 80110317 |
| C305 | CAPACITOR,15PF,500VDCW | 72136 | DM15C150J0500WV4CR | 80115010 |
| C306 | CAPACITOR,100PF,250VDCW | 80031 | CV15GC102K | 80175001 |
| C307 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C308 | CAPACITOR,51PF,500VDCW | 72136 | DM15E510J0500WV4CR | 80115022 |
| C309 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C310 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C311 | CAPACITOR,33UF,20VDCW | 12954 | D33GC20K | 80168057 |
| C312 | CAPACITOR,2.2UF,35VDCW | 12954 | D2R2GB35K | 80168063 |
| C313 | CAPACITOR,.047UF,25VDCW | 05397 | KR47M25X | 80167059 |
| C314 | CAPACITOR,.033UF,200VDCW | 14655 | WMF-2S3 | 80127007 |
| C315 | CAPACITOR,.033UF,200VDCW | 14655 | WMF-2S3 | 80127007 |
| C316 | CAPACITOR,470PF,500VDCW | 72136 | DM15E471J0500WV4CR | 80115047 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| C317 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C318 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C319 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C320 | CAPACITOR,100PF,500VDCW | 72136 | DM15E101J0500WV4CR | 80115027 |
| C321 | NOT USED | | | |
| C322 | NOT USED | | | |
| C323 | NOT USED | | | |
| C324 | NOT USED | | | |
| C325 | NOT USED | | | |
| C326 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C327 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C328 | CAPACITOR,100PF,250VDCW | 80031 | CV15GC102K | 80175001 |
| C329 | CAPACITOR,100PF,250VDCW | 80031 | CV15GC102K | 80175001 |
| C330 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C331 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C332 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C333 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C334 | CAPACITOR,4700PF,500VDCW | 72136 | DM19E432J0500WV4CR | 80115066 |
| C335 | NOT USED | | | |
| C336 | NOT USED | | | |
| C337 | NOT USED | | | |
| C338 | NOT USED | | | |
| C339 | NOT USED | | | |
| C340 | CAPACITOR,100PF,250VDCW | 80031 | CV15GC102K | 80175001 |
| C341 | CAPACITOR,100PF,500VDCW | 72136 | DM15E101J0500WV4CR | 80115027 |
| C342 | CAPACITOR,22UF,20VDCW | 12954 | D22GB20K | 80168056 |
| C343 | CAPACITOR,1UF,25VDCW | 31433 | K1W25K | 80167061 |
| C344 | NOT USED | | | |
| C345 | CAPACITOR,1800PF,250VDCW | 80031 | CV15GC182K | 80175002 |
| C346 | CAPACITOR,100PF,250VDCW | 80031 | CV15GC102K | 80175001 |
| C401 | CAPACITOR,1000UF,25VDCW | 14655 | BR1000-25 | 80120015 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| C402 | CAPACITOR,15UF,35VDCW | 12954 | D15GC35K | 80168068 |
| C403 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C404 | CAPACITOR,4700PF,500VDCW | 72136 | DM19E432J0500WV4CR | 80115066 |
| C405 | CAPACITOR,75UF,25VDCW | 73445 | 30D356G025DC0 | 80121029 |
| C406 | CAPACITOR,4700PF,500VDCW | 72136 | DM19E432J0500WV4CR | 80115066 |
| C407 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C408 | CAPACITOR,75UF,25VDCW | 73445 | 30D356G025DC0 | 80121029 |
| C409 | CAPACITOR,1000UF,25VDCW | 14655 | BR1000-25 | 80120015 |
| C410 | CAPACITOR,15UF,35VDCW | 12954 | D15GC35K | 80168068 |
| C411 | CAPACITOR,4700PF,500VDCW | 72136 | DM19E432J0500WV4CR | 80115066 |
| C412 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C413 | CAPACITOR,75UF,25VDCW | 73445 | 30D356G025DC0 | 80121029 |
| C414 | CAPACITOR,4700PF,500VDCW | 72136 | DM19E432J0500WV4CR | 80115066 |
| C415 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C416 | CAPACITOR,75UF,25VDCW | 73445 | 30D356G025DC0 | 80121029 |
| C501 | CAPACITOR,250UF,50VDCW | 14655 | BR-250-50 | 80120046 |
| C502 | CAPACITOR,4700PF,500VDCW | 72136 | DM19E432J0500WV4CR | 80115066 |
| C503 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C504 | CAPACITOR,22UF,50VDCW | 56289 | 150D684X9050A2 | 80125075 |
| C505 | CAPACITOR,25UF,50VDCW | 14655 | BBR25-50 | 80120017 |
| C506 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C507 | CAPACITOR,4700PF,500VDCW | 72136 | DM19E432J0500WV4CR | 80115066 |
| C508 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C509 | CAPACITOR,22UF,50VDCW | 56289 | 150D684X9050A2 | 80125075 |
| C510 | CAPACITOR,4700PF,500VDCW | 72136 | DM19E432J0500WV4CR | 80115066 |
| C511 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C512 | CAPACITOR,260UF,16VDCW | 56289 | 30D257G016DF | 80121052 |
| C513 | CAPACITOR,3.3UF,15VDCW | 12954 | D3R3GA15K | 80168037 |
| C601 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C602 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C603 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| C604 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C605 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C606 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C607 | CAPACITOR,47PF,500VDCW | 72136 | DM15E470J0500WV4CR | 80115021 |
| C608 | CAPACITOR,.6800PF, | 95275 | CK06BX683K | 80187001 |
| C609 | NOT USED | | | |
| C610 | CAPACITOR,.01UF | 95275 | CK05BX103K | 80187000 |
| C611 | CAPACITOR,.01UF | 95275 | CK05BX103K | 80187000 |
| C612 | CAPACITOR,.01UF | 95275 | CK05BX103K | 80187000 |
| C613 | CAPACITOR,2200PF,500VDCW | 72136 | DM19E220J0500WV4CR | 80115058 |
| C614 | NOT USED | | | |
| C615 | CAPACITOR,.012UF | 95275 | CK05BX103K | 80187000 |
| C616 | CAPACITOR,.01UF | 95275 | CK05BX103K | 80187000 |
| C617 | NOT USED | | | |
| C618 | CAPACITOR,47PF,500VDCW | 72136 | DM15E470J0500WV4CR | 80115021 |
| C619 | CAPACITOR,470PF,500VDCW | 72136 | DM15E471J0500WV4CR | 80115043 |
| C620 | CAPACITOR,1000PF,500VDCW | 72136 | DM19E102J0500WV4CR | 80115051 |
| C621 | CAPACITOR,2200PF,500VDCW | 72136 | DM19E220J0500WV4CR | 80115058 |
| C622 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C623 | SELECT AT TEST | | | |
| C624 | NOT USED | | | |
| C701 | NOT USED | | | |
| C702 | NOT USED | | | |
| C703 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C704 | NOT USED | | | |
| C705 | CAPACITOR,.47UF,25VDCW | 72982 | 5865-000Y5U474Z | 80123011 |
| C706 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C707 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C708 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C709 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |
| C710 | CAPACITOR,10PF,500VDCW | 72136 | DM15C100J0500WV4CR | 80115008 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| C711 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C712 | CAPACITOR,15UF,35VDCW | 12954 | D15GC35K | 80168068 |
| C713 | CAPACITOR,1000PF,500WVDC | 72136 | DM19E102J | 80115051 |
| C714 | CAPACITOR,470PF,500VDCW | 72136 | DM15E471J0500WV4CR | 80115043 |
| C715 | CAPACITOR,2200PF,500VDCW | 72136 | DM19E220J0500WV4CR | 80115058 |
| C716 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C717 | NOT USED | | | |
| C718 | NOT USED | | | |
| C801 | CAPACITOR,22UF,6VDCW | 05397 | K22W6K | 80167015 |
| C802 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C803 | CAPACITOR,4.7UF,35VDCW | 12954 | D3R36B35K | 80168065 |
| C804 | CAPACITOR,4.7UF,35VDCW | 12954 | D3R36B35K | 80168065 |
| C805 | CAPACITOR,10UF,20VDCW | 12954 | D10GB20K | 80168054 |
| C806 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C807 | CAPACITOR,10UF,10VDCW | 05397 | K10W10K | 80167028 |
| C808 | CAPACITOR,1.0UF,50VDCW | 05397 | K1W50K | 80167082 |
| C809 | CAPACITOR,4.7UF,35VDCW | 12954 | D3R36B35K | 80168065 |
| C901 | CAPACITOR,.01UF,25VDCW | 72982 | 5835-000Y5V103Z | 80123006 |
| C1001 | CAPACITOR,10,000UF,3VDCW | 56289 | 39D109G003HS4 | 80172000 |
| C1002 | CAPACITOR,250UF,40VDCW | 73445 | C437-G250 | 80194000 |
| C1100 | NOT USED | | | |
| C1101 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| C1102 | NOT USED | | | |
| C1103 | CAPACITOR,.1UF,25VDCW | 72982 | 5815-000Y5U104Z | 80123009 |
| CR1 | DIODE | 12954 | IN759A | 84513014 |
| CR2 | DIODE | 12954 | IN462 | 84512001 |
| CR3 | DIODE | 12954 | IN462 | 84512001 |
| CR4 | DIODE | 12954 | IN1777A | 84514013 |
| CR5 | DIODE | 12954 | IN1777A | 84514013 |
| CR6 | DIODE | 12954 | IN462 | 84512001 |
| CR7 | DIODE | 12954 | IN462 | 84512001 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| CR8 | NOT USED | | | |
| CR9 | DIODE | 12954 | IN462 | 84512001 |
| CR10 | DIODE | 12954 | IN462 | 84512001 |
| CR11 | DIODE | 13327 | SOD100D | 84522004 |
| CR12 | DIODE | 13327 | SOD100D | 84522004 |
| CR13 | DIODE | 13327 | SOD100D | 84522004 |
| CR14 | DIODE | 13327 | SOD100D | 84522004 |
| CR15 | DIODE | 99899 | VS248 | 84545000 |
| CR16 | DIODE | 12954 | IN914 | 84512007 |
| CR17 | DIODE | 12954 | IN914 | 84512007 |
| CR18 | DIODE | 12954 | IN914 | 84512007 |
| CR19 | DIODE | 12954 | IN914 | 84512007 |
| CR20 | DIODE,ZENER | 81483 | IN971B | 84512010 |
| CR21 | DIODE | 12954 | IN462 | 84512001 |
| CR22 | DIODE | 12954 | IN462 | 84512001 |
| CR23 | DIODE | 12954 | IN462 | 84512001 |
| CR24 | DIODE | 12954 | IN462 | 84512001 |
| CR25 | DIODE | 12954 | IN462 | 84512001 |
| CR101 | DIODE | 12954 | IN462 | 84512001 |
| CR102 | DIODE | 12954 | IN753A | 84513008 |
| CR103 | DIODE | 12954 | IN914 | 84512007 |
| CR104 | DIODE | 12954 | IN746A | 84513001 |
| CR105 | DIODE | 12954 | IN759A | 84513014 |
| CR106 | DIODE | 12954 | IN753A | 84513008 |
| CR107 | NOT USED | | | |
| CR108 | NOT USED | | | |
| CR109 | DIODE | 12954 | IN462 | 84512001 |
| CR110 | DIODE | 12954 | IN462 | 84512001 |
| CR111 | DIODE | 12954 | IN462 | 84512001 |
| CR201 | DIODE | 12954 | IN462 | 84512001 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| CR202 | DIODE | 12954 | IN462 | 84512001 |
| CR203 | DIODE | 12954 | IN759A | 84513014 |
| CR204 | DIODE | 12954 | IN753A | 84513008 |
| CR205 | DIODE | 12954 | IN462 | 84512001 |
| CR206 | DIODE | 12954 | IN462 | 84512001 |
| CR207 | DIODE | 12954 | IN462 | 84512001 |
| CR208 | DIODE | 12954 | IN759A | 84513014 |
| CR209 | DIODE | 12954 | IN753A | 84513008 |
| CR301 | DIODE | 12954 | IN462 | 84512001 |
| CR302 | DIODE | 12954 | IN759A | 84513014 |
| CR303 | DIODE | 12954 | IN753A | 84513008 |
| CR304 | DIODE | 12954 | IN759A | 84513014 |
| CR305 | DIODE | 12954 | IN759A | 84513014 |
| CR306 | DIODE | 12954 | IN753A | 84513008 |
| CR307 | NOT USED | | | |
| CR308 | NOT USED | | | |
| CR309 | DIODE | 12954 | IN462 | 84512001 |
| CR310 | NOT USED | | | |
| CR311 | DIODE | 12954 | IN462 | 84512001 |
| CR312 | DIODE | 12954 | IN462 | 84512001 |
| CR313 | DIODE | 12954 | IN914 | 84512007 |
| CR401 | DIODE | 99899 | VS248 | 84545000 |
| CR402 | NOT USED | | | |
| CR403 | NOT USED | | | |
| CR404 | NOT USED | | | |
| CR405 | DIODE,ZENER | 12954 | IN944A | 84543002 |
| CR406 | DIODE | 99899 | VS248 | 84545000 |
| CR407 | NOT USED | | | |
| CR408 | NOT USED | | | |
| CR409 | NOT USED | | | |
| CR410 | DIODE,ZENER | | | |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| CR411 | DIODE | 12954 | IN759A | 84513014 |
| CR501 | DIODE | 99899 | VS248 | 84545000 |
| CR502 | NOT USED | | | |
| CR503 | NOT USED | | | |
| CR504 | NOT USED | | | |
| CR505 | DIODE | 12954 | IN759A | 84513014 |
| CR506 | DIODE | 12954 | IN759A | 84513014 |
| CR507 | NOT USED | | | |
| CR508 | NOT USED | | | |
| CR509 | NOT USED | | | |
| CR510 | DIODE | 12954 | IN746A | 84513001 |
| CR511 | DIODE,ZENER | 81483 | IN927B | 84512009 |
| CR512 | DIODE | 12954 | IN 462 | 84512001 |
| CR601 | DIODE | 12954 | IN462 | 84512001 |
| CR602 | DIODE | 12954 | IN462 | 84512001 |
| CR603 | DIODE | 12954 | IN462 | 84512001 |
| CR604 | DIODE | 12954 | IN462 | 84512001 |
| CR605 | DIODE | 12954 | IN462 | 84512001 |
| CR606 | DIODE | 12954 | IN462 | 84512001 |
| CR607 | DIODE | 12954 | IN462 | 84512001 |
| CR608 | DIODE | 12954 | IN462 | 84512001 |
| CR609 | DIODE | 12954 | IN 462 | 84512001 |
| CR610 | DIODE | 12954 | IN 462 | 84512001 |
| CR611 | DIODE | 12954 | IN 462 | 84512001 |
| CR612 | DIODE | 12954 | IN 462 | 84512001 |
| CR613 | DIODE | 12954 | IN 462 | 84512001 |
| CR614 | DIODE | 12954 | IN 462 | 84512001 |
| CR615 | DIODE | 12954 | IN 462 | 84512001 |
| CR616 | DIODE | 12954 | IN462 | 84512001 |
| CR617 | DIODE | 01295 | IN645 | 84512005 |
| CR618 | DIODE | 12954 | IN462 | 84512001 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| CR619 | DIODE | 12954 | IN462 | 84512001 |
| CR620 | DIODE | 12954 | IN462 | 84512001 |
| CR701 | DIODE | 12954 | IN914 | 84512007 |
| CR702 | DIODE | 12954 | IN914 | 84512007 |
| CR703 | DIODE | 12954 | IN914 | 84512007 |
| CR704 | DIODE | 12954 | IN914 | 84512007 |
| CR705 | DIODE | 12954 | IN914 | 84512007 |
| CR706 | DIODE | 12954 | IN914 | 84512007 |
| CR707 | DIODE | 12954 | IN914 | 84512007 |
| CR708 | DIODE | 12954 | IN914 | 84512007 |
| CR709 | DIODE,ZENER | 12954 | IN944A | 84543002 |
| CR801 | DIODE | 12954 | IN462 | 84512001 |
| CR802 | DIODE | 12954 | IN462 | 84512001 |
| CR803 | DIODE | 12954 | IN462 | 84512001 |
| CR804 | DIODE | 12954 | IN462 | 84512001 |
| CR805 | DIODE | 12954 | IN462 | 84512001 |
| CR806 | DIODE | 12954 | IN462 | 84512001 |
| CR807 | DIODE | 12954 | IN462 | 84512001 |
| CR808 | DIODE | 12954 | IN462 | 84512001 |
| CR809 | DIODE | 12954 | IN753A | 84513008 |
| CR810 | DIODE | 12954 | IN462 | 84512001 |
| CR811 | DIODE | 12954 | IN462 | 84512001 |
| CR812 | DIODE | 12954 | IN759A | 84513014 |
| CR813 | DIODE | 12954 | IN462 | 84512001 |
| CR814 | DIODE | 12954 | IN914 | 84512007 |
| CR815 | DIODE | 12954 | IN914 | 84512007 |
| CR1001 | DIODE | 13327 | CER-71 | 84522006 |
| CR1100 | NOT USED | | | |
| CR1101 | DIODE | 13327 | CER-71 | 84522006 |
| CR1102 | DIODE | 12954 | IN462 | 84512001 |
| CR1103 | DIODE | 13327 | CER-71 | 84522006 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| CR1104 | DIODE | 13327 | CER-71 | 84522006 |
| DS1 | LAMP CARTRIDGE,FLAT,RED (PART OF R1004) | 72619 | | 82019001 |
| DS2 | LAMP CARTRIDGE,FLAT,BLUE | 72619 | | 82019002 |
| DS3 | LAMP CARTRIDGE, | | | 82019004 |
| DS4 | LAMP CARTRIDGE,FLAT,YELLOW | 72619 | | 82019003 |
| DS801 | LAMP | 72619 | 387 | 82018000 |
| DS802 | LAMP | 72619 | 387 | 82018000 |
| DS803 | LAMP | 72619 | 387 | 82018000 |
| DS804 | LAMP | 72619 | 387 | 82018000 |
| DS805 | LAMP | 72619 | 387 | 82018000 |
| DS806 | LAMP | 72619 | 387 | 82018000 |
| DS807 | LAMP | 72619 | 387 | 82018000 |
| DS808 | LAMP | 72619 | 387 | 82018000 |
| F1 | FUSE,2ASB | 75915 | 313002 | 81002024 |
| F2 | FUSE,3AMP | 75915 | 275003 | 81007000 |
| F1101 | FUSE,3/8AMP | 75915 | 259.375 | 81006000 |
| H401 | OVEN | 01295 | 3ST1-2 | 89801000 |
| H402 | OVEN | 01295 | 4ST1-2 | 89802000 |
| H601 | OVEN | 01295 | 4ST1-2 | 89802000 |
| H602 | OVEN | 01295 | 3ST1-2 | 89801000 |
| H701 | OVEN | 01295 | 3ST1-2 | 89801000 |
| H702 | OVEN | 01295 | 4ST1-2 | 89802000 |
| H703 | OVEN | 01295 | 4ST1-2 | 89802000 |
| HG1001 | MULTIPLIER | 99899 | | 00204935 |
| IC101 | INTEGRATED CIRCUIT | 07263 | 710C | 84534002 |
| IC102 | INTEGRATED CIRCUIT (SELECTED) | 99899 | | 84581000 |
| IC103 | INTEGRATED CIRCUIT | 07263 | 710C | 84534002 |
| IC104 | INTEGRATED CIRCUIT (SELECTED) | 99899 | | 84581000 |
| IC201 | INTEGRATED CIRCUIT (SELECTED) | 99899 | | 84581000 |
| IC202 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC203 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| IC204 | INTEGRATED CIRCUIT | 07263 | 711C | 84546002 |
| IC205 | INTEGRATED CIRCUIT | 07263 | 711C | 84546002 |
| IC206 | INTEGRATED CIRCUIT (SELECTED) | 99899 | | 84581000 |
| IC207 | INTEGRATED CIRCUIT | 07263 | 710C | 84534002 |
| IC301 | INTEGRATED CIRCUIT | 07263 | 702C | 84528002 |
| IC302 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC303 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC304 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC401 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC402 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC403 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC404 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC501 | INTEGRATED CIRCUIT | 07263 | 709C | 84533002 |
| IC502 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC503 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC601 | INTEGRATED CIRCUIT | 07263 | 715C | 84551000 |
| IC602 | INTEGRATED CIRCUIT (SELECTED) | 99899 | | 84581000 |
| IC603 | INTEGRATED CIRCUIT (SELECTED) | 99899 | | 84581000 |
| IC701 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC702 | INTEGRATED CIRCUIT | 07263 | 715C | 84551000 |
| IC703 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC704 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC705 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC706 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC801 | INTEGRATED CIRCUIT | 07263 | 701C | 84534002 |
| IC802 | INTEGRATED CIRCUIT | 07263 | IC701C | 84534002 |
| IC901 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC902 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC903 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC904 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| IC1100 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| IC1102 | INTEGRATED CIRCUIT | 07263 | 741C | 84548000 |
| ISOL1001 | OSCILLATOR ASSEMBLY | 99899 | | 8693000 |
| J1 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J2 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J3 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J4 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J5 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J6 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J7 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J8 | BINDING POST | 83330 | 1517 | 87114001 |
| J9 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J10 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J11 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J12 | NOT USED | | | |
| J13 | NOT USED | | | |
| J14 | POWER OUTLET | 87930 | 1061-4 | 81520000 |
| J15 | NOT USED | | | |
| J16 | NOT USED | | | |
| J17 | NOT USED | | | |
| J18 | NOT USED | | | |
| J19 | NOT USED | | | |
| J20 | CONNECTOR,RECEPTACLE | 91836 | KC 79 35 | 81524000 |
| J1001 | CONNECTOR,MINIATURE | 02660 | 57-40240 | 81588004 |
| J1101 | CONNECTOR, | 81312 | 8BDI85 | 81617000 |
| K1 | RELAY 26VDCW | 14655 | 1077603-28V | 83551000 |
| K2 | RELAY,REED,1000 VOLTS | 12965 | OPCIC24 | 83553000 |
| K3 | RELAY, | 70309 | TF154CC-CC24VDC | 83565000 |
| K4 | RELAY | 70309 | TF351-C-C-2/1L | 83568000 |
| K301 | RELAY,REED,1000 VOLTS | 12965 | OPCIC24 | 83553000 |
| K601 | RELAY | 12965 | 100649 | 83582000 |
| K701 | RELAY,REED,1000 VOLTS | 12965 | OPCIC24 | 83553000 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| K801 | RELAY,24VDCW,DC COIL | 70309 | TP154CCC-CCC24VDC | 83543008 |
| K802 | RELAY,24VDCW,DC COIL | 70309 | TP154CCC-CCC24VDC | 83543008 |
| K803 | RELAY,24VDCW,DC COIL | 70309 | TP154CCC-CCC24VDC | 83543008 |
| K804 | RELAY,24VDCW,DC COIL | 70309 | TP154CCC-CCC24VDC | 83543008 |
| K805 | RELAY,24VDCW,DC COIL | 70309 | TP154CCC-CCC24VDC | 83543008 |
| K806 | RELAY,24VDCW,DC COIL | 70309 | TP154CCC-CCC24VDC | 83543008 |
| K807 | RELAY,24VDCW,DC COIL | 70309 | TP154CCC-CCC24VDC | 83543008 |
| K808 | RELAY,24VDCW,DC COIL | 70309 | TP154CCC-CCC24VDC | 83543008 |
| K809 | RELAY 24VDCW,DC COIL | 70309 | TP154C-C24VDC | 83543002 |
| K810 | RELAY 24VDCW,DC COIL | 70309 | TP154C-C24VDC | 83543002 |
| K1001 | RELAY,REED,1000 VOLTS | 12965 | OPCIC24 | 83553000 |
| L1 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L301 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L302 | NOT USED | | | |
| L303 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L304 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L305 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L306 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L307 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L308 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L309 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| L310 | CHOKE,68UH | 76493 | 9240-730 | 84602035 |
| M1 | METER | 81030 | 1122 | 82519000 |
| OSC1000 | OSCILLATOR | 99899 | | 86902000 |
| OSC1001 | OSCILLATOR | 99899 | | 86911000 |
| Q1 | TRANSISTOR | 02735 | 2N3055 | 89018067 |
| Q2 | TRANSISTOR | 01295 | T13027 | 89018068 |
| Q3 | TRANSISTOR | 02735 | 2N3055 | 89018067 |
| Q4 | TRANSISTOR | 02735 | 40250 | 89018008 |
| Q5 | TRANSISTOR | 02735 | 40250 | 89018008 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| Q6 | TRANSISTOR | 02735 | 40250 | 89018008 |
| Q7 | TRANSISTOR | 02735 | 40250 | 89018008 |
| Q8 | TRANSISTOR | 02735 | 40250 | 89018008 |
| Q101 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q102 | TRANSISTOR | 07263 | 2N3563 | 89018029 |
| Q103 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q104 | TRANSISTOR | 07263 | 2N3563 | 89018029 |
| Q105 | TRANSISTOR | 07263 | 2N3563 | 89018029 |
| Q106 | TRANSISTOR | 04713 | 2N834 | 89018030 |
| Q201 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q202 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q203 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q301 | TRANSISTOR | 04713 | 2N834 | 89018030 |
| Q302 | TRANSISTOR | 04713 | 2N834 | 89018030 |
| Q303 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q304 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q305 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q306 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q307 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q308 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q309 | TRANSISTOR | 04713 | 2N834 | 89018030 |
| Q310 | TRANSISTOR | 01295 | ZN1307 | 89020014 |
| Q401 | TRANSISTOR | 02735 | 2N3055 | 89018067 |
| Q402 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q403 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q404 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q405 | TRANSISTOR | 02735 | 2N3055 | 89018067 |
| Q406 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q407 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q408 | TRANSISTOR | 02735 | 2N1307 | 89018027 |
| Q501 | TRANSISTOR | 02735 | 2N3055 | 89018067 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| Q502 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q503 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q504 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q505 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q506 | TRANSISTOR | 02735 | 2N697 | 89018004 |
| Q507 | TRANSISTOR | 02735 | 2N1307 | 89018027 |
| Q508 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q509 | TRANSISTOR | 02735 | 2N1307 | 89018027 |
| Q601 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q602 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q603 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q604 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q605 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q606 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q607 | TRANSISTOR | 02735 | 2N1306 | 89018026 |
| Q608 | TRANSISTOR | 01295 | 2N5548 | 89018231 |
| Q609 | TRANSISTOR | 01295 | 2N5548 | 89018231 |
| Q610 | TRANSISTOR | 01295 | 2N5548 | 89018231 |
| Q701 | TRANSISTOR | 02735 | 2N2944 | 89018161 |
| Q702 | TRANSISTOR | 02735 | 2N2944 | 89018161 |
| Q703 | TRANSISTOR | 02735 | 2N2944 | 89018161 |
| Q704 | TRANSISTOR | 02735 | 2N2944 | 89018161 |
| Q705 | TRANSISTOR | 02735 | TN80 | 89018162 |
| Q706 | TRANSISTOR | 02735 | TN80 | 89018162 |
| Q707 | TRANSISTOR | 02735 | TN80 | 89018162 |
| Q708 | TRANSISTOR | 02735 | TN80 | 89018162 |
| Q709 | TRANSISTOR | 02735 | TN80 | 89018162 |
| Q801 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q802 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q1101 | TRANSISTOR | 02735 | 2N1307 | 89018027 |
| Q1102 | NOT USED | | | |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| Q1103 | NOT USED | | | |
| Q1104 | NOT USED | | | |
| Q1105 | TRANSISTOR | 07263 | 2N3568 | 89018006 |
| Q1106 | TRANSISTOR | 02735 | 2N1307 | 89018027 |
| R1 | NOT USED | | | |
| R2 | RES,FIXED COMP,2.2K,1/4W, 5% | 01121 | RC07GF222T | 83015057 |
| R3 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R4 | RES,FIXED COMP,8.2K,1/4W, 5% | 01121 | RC07GF822T | 83015071 |
| R5 | RES,FIXED COMP,2.2K,1/4W, 5% | 01121 | RC07GF222T | 83015057 |
| R6 | RES,FIXED COMP,7500 OHM,1/4W, 5% | 01121 | RC07GF752T | 83015070 |
| R7 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R8 | RES,FIXED COMP,1 MEG,1/4W, 5% | 01121 | RC07GF105T | 83015121 |
| R9 | PART OF S6 | | | |
| R10 | RES,FIXED COMP,2.2K,1/4W, 5% | 01121 | RC07GF222T | 83015057 |
| R11 | RES,FIXED COMP,1 MEG,1/4W, 5% | 01121 | RC07GF105T | 83015121 |
| R12 | RES,VARIABLE,1MEG,2W, 10% | 01121 | 0445105MA | 83056125 |
| R13 | RES,VARIABLE,10K,.2W, 10% | 01121 | 0445103UA | 83056113 |
| R14 | RES,FIXED COMP,510 OHM,1/4W, 5% | 01121 | RC07GF511T | 83015042 |
| R15 | RES,FIXED COMP,510 OHM,1/4W, 5% | 01121 | RC07GF511T | 83015042 |
| R16 | RES,FIXED COMP,510 OHM,1/4W, 5% | 01121 | RC07GF511T | 83015042 |
| R17 | RES,VARIABLE,50HM/100K,5W, 10%-30% | 71450 | C2-AW | 83105000 |
| R18 | RES,FIXED COMP,1.2K,1/4W, 5% | 01121 | RC07GF122T | 83015051 |
| R19 | NOT USED | | | |
| R20 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R21 | RES,FIXED COMP,1.5K,1W. 5% | 01121 | RC32GF152J | 83014053 |
| R22 | RES,FIXED COMP,330 OHM,2W, 5% | 01121 | RC42GF3313 | 83011037 |
| R23 | RES,VARIABLE,10K,.2W, 10% | 01121 | 0445103UA | 83056113 |
| R24 | RES,VARIABLE,50HM/100K,5W, 10%-30% | 71450 | C2-AW | 83105000 |
| R25 | RES,METAL FILM,12.9K,1/4W, .1% | 07716 | CCA-T2 | 83098002 |
| R26 | NOT USED | | | |
| R27 | RES,FIXED COMP,10 OHM,1/4W, 5% | 01121 | RC07GF100T | 8301500 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R28 | RES,METAL OXIDE,909 OHM,1/4W, 1% | 07716 | CCA-T2 | 83097188 |
| R29 | RES,METAL OXIDE,124 OHM,1/4W, 1% | 07716 | CCA-T2 | 83097106 |
| R30 | RES,METAL OXIDE,909 OHM,1/4W, 1% | 07716 | CCA-T2 | 83097188 |
| R31 | RES,METAL OXIDE,124 OHM,1/4W, 1% | 07716 | CCA-T2 | 83097106 |
| R32 | RES,METAL OXIDE,909 OHM,1/4W, 1% | 07716 | CCA-T2 | 83097188 |
| R33 | RES,METAL OXIDE,110 OHM,1/4W, 1% | 07716 | CCA-T2 | 83097101 |
| R34 | RES,VARIABLE,2.5 OHM,2W, 10% | 71450 | 2-AW | 83104000 |
| R35 | PART OF R34 | | | |
| R36 | RES,MOLDED WIRE WOUND.43 OHM,2W, 5% | | BWH | 83034007 |
| R37 | RES,MOLDED WIRE WOUND.43 OHM,2W, 5% | | BWH | 83034007 |
| R38 | RES,FIXED COMP,6.2K,1/4W, 5% | 01121 | RC07GF622T | 83015068 |
| R39 | VOLTAGE DIVIDER | 99899 | | 83537003 |
| R40 | VOLTAGE DIVIDER | 99899 | | 83537001 |
| R41 | VOLTAGE DIVIDER | 99899 | | 83537002 |
| R42 | VOLTAGE DIVIDER | 99899 | | 83537004 |
| R43 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R44 | RES,MOLDED WIRE WOUND.51 OHM,1W, 5% | 75042 | BWH | 83034009 |
| R45 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R46 | RES,FIXED COMP,6800 OHM,1W, 5% | 01121 | RC07GF682T | 83015069 |
| R47 | RES,FIXED COMP,300 OHM,1W, 5% | 01121 | RC32GF301J | 83014036 |
| R48 | RES,FIXED COMP,22K,1/4W, 5% | 01121 | RC07GF223T | 83015081 |
| R49 | RES,FIXED COMP,470 OHM,1/2W, 5% | 01121 | R20GF471J | 83010041 |
| R50 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R51 | VOLTAGE DIVIDER ASSY | 99899 | | 203526 |
| R52 | NOT USED | | | |
| R53 | NOT USED | | | |
| R54 | RES,WIRE WOUND.47 OHM,2W, 5% | 75042 | BWH | 83034008 |
| R55 | NOT USED | | | |
| R56 | RES,WIREWOUND 1.5 OHM,2W,5% | 75042 | BWH | 83034020 |
| R57 | NOT USED | | | |
| R58 | NOT USED | | | |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R59 | NOT USED | | | |
| R60 | RES,FIXED COMP,100 OHM,1/4W, 5% | 01121 | RC07GF101T | 83015025 |
| R61 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R62 | RES,WIRE WOUND 10 OHM,5W, 5% | 56289 | RW576100 | 83042049 |
| R101 | RES,FIXED COMP,2.7K,1/4W, 5% | 01121 | RC07GF272T | 83015059 |
| R102 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R103 | RES,FIXED COMP,820K,1/4W, 5% | 01121 | RC07GF824T | 83015119 |
| R104 | RES,FIXED COMP,150K,1/4W, 5% | 01121 | RC07GF154T | 83015101 |
| R105 | RES,FIXED COMP,2.2K,1/4W, 5% | 01121 | RC07GF222T | 83015057 |
| R106 | RES,FIXED COMP,3.9K,1/4W, 5% | 01121 | RC07GF392T | 83015063 |
| R107 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R108 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123T | 83015075 |
| R109 | RES,FIXED COMP,3.9K,1/4W, 5% | 01121 | RC07GF392T | 83015063 |
| R110 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123T | 83015075 |
| R111 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R112 | RES,FIXED COMP,2.2K,1/4W, 5% | 01121 | RC07GF222T | 83015057 |
| R113 | RES,FIXED COMP,120K,1/4W, 5% | 01121 | RC07GF124T | 83015099 |
| R114 | RES,FIXED COMP,39K,1/4W, 5% | 01121 | RC07GF393T | 83015087 |
| R115 | NOT USED | | | |
| R116 | NOT USED | | | |
| R117 | RES,FIXED COMP,6800 OHM,1W, 5% | 01121 | RC07GF682T | 83015069 |
| R118 | RES,FIXED COMP,3.9K,1/4W, 5% | 01121 | RC07GF392T | 83015063 |
| R119 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273T | 83015083 |
| R120 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273T | 83015083 |
| R121 | RES,FIXED COMP,3K,1/4W, 5% | 01121 | RC07GF302T | 83015060 |
| R122 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R123 | NOT USED | | | |
| R124 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R125 | RES,FIXED COMP,470K,1/4W, 5% | 01121 | RC07GF474T | 83015113 |
| R126 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R127 | RES,FIXED COMP,51 OHM,1/4W, 5% | 01121 | RC07GF510T | 83015018 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R128 | RES,FIXED COMP,39K,1/4W, 5% | 01121 | RC07GF393T | 83015087 |
| R129 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R130 | RES,METAL OXIDE,14K,1/4W, 1% | 07716 | CCA-T2 | 83097302 |
| R131 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R132 | RES,METAL OXIDE,6.98K,1/4W, 1% | 07716 | CCA-T2 | 83097273 |
| R133 | RES,FIXED COMP,180 OHM,1/4W, 5% | 01121 | RC07GF181T | 83015031 |
| R134 | RES,FIXED COMP,430 OHM,1/4W, 5% | 01121 | RC07GF431T | 83015040 |
| R135 | RES,FIXED COMP,2.7K,1/4W, 5% | 01121 | RC07GF272T | 83015059 |
| R136 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R137 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R138 | RES,FIXED COMP,3.9K,1/4W, 5% | 01121 | RC07GF392T | 83015063 |
| R139 | RES,METAL OXIDE,5.23K,1/4W, 1% | 07716 | CCA-T2 | 83097261 |
| R140 | RES,METAL OXIDE,6.49K,1/8W, 1% | 07716 | CCA-T2 | 83097270 |
| R141 | RES,VARIABLE,10K,1/2W, 10% | 80294 | 3067P-1-101 | 83096008 |
| R142 | RES,METAL FILM,100K,1/8W, 1% | 82142 | JC200 | 83098009 |
| R143 | RES,METAL FILM,100K,1/8W, 1% | 82142 | JC200 | 83098009 |
| R144 | RES,METAL OXIDE,97.6K,1/4W, 1% | 07716 | CCA-T2 | 83097382 |
| R145 | NOT USED | | | |
| R146 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473T | 83015089 |
| R147 | RES,VARIABLE,5K1/2W, 10% | 80294 | 3067P-1-502 | 83096007 |
| R148 | NOT USED | | | |
| R149 | NOT USED | | | |
| R150 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R151 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R152 | RES,METAL OXIDE,4.99K,1/4W, 1% | 07716 | CCA-T2 | 83097259 |
| R153 | RES,METAL OXIDE,1.87K,1/4W, 1% | 07716 | CCA-T2 | 83097218 |
| R154 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R155 | RES,FIXED COMP,39K,1/4W, 5% | 01121 | RC07GF393T | 83015087 |
| R156 | RES,FIXED COMP,470K,1/4W, 5% | 01121 | RC07GF474T | 83015113 |
| R157 | NOT USED | | | |
| R158 | RES,VARIABLE,1K,1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R201 | RES,METAL FILM,10K,1/4W, .1% | 07716 | CCA-T2 | 83098006 |
| R202 | RES,METAL FILM,10K,1/4W, .1% | 07716 | CCA-T2 | 83098006 |
| R203 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R204 | RES,VARIABLE,10K1/2W, 10% | 80294 | 3067P-1-103 | 83096008 |
| R205 | NOT USED | | | |
| R206 | RES,METAL FILM,10K,1/4W, .1% | 07716 | CCA-T2 | 83098006 |
| R207 | NOT USED | | | |
| R208 | RES,FIXED COMP,68K,1/4W, 5% | 01121 | RC07GF683T | 83015093 |
| R209 | RES,METAL FILM,20K1/4W, .1% | 07716 | CCA-T2 | 83098008 |
| R210 | RES,METAL FILM,20K1/4W, .1% | 07716 | CCA-T2 | 83098008 |
| R211 | RES,METAL FILM,7K,1/4W, .1% | 07716 | CCA-T2 | 83098007 |
| R212 | RES,METAL FILM,7K,1/4W, .1% | 07716 | CCA-T2 | 83098007 |
| R213 | RES,FIXED COMP,51 OHM,1/4W, 5% | 01121 | RC07GF510T | 83015018 |
| R214 | RES,VARIABLE,100K,1/2W, 10% | 30983 | ET34Y104 | 83096011 |
| R215 | RES,FIXED COMP,470K,1/4W, 5% | 01121 | RC07GF474T | 83015113 |
| R216 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R217 | RES,METAL FILM,20K1/4W, .1% | 07716 | CCA-T2 | 83098008 |
| R218 | RES,METAL FILM,20K1/4W, .1% | 07716 | CCA-T2 | 83098008 |
| R219 | RES,METAL FILM,7K,1/4W, .1% | 07716 | CCA-T2 | 83098007 |
| R220 | RES,METAL FILM,7K,1/4W, .1% | 07716 | CCA-T2 | 83098007 |
| R221 | RES,FIXED COMP,470K,1/4W, 5% | 01121 | RC07GF510T | 83015018 |
| R222 | RES VARIABLE,100K,1/2W, 10% | 30983 | ET34Y104 | 83096011 |
| R223 | RES,FIXED COMP,470K,1/4W, 5% | 01121 | RC07GF474T | 83015113 |
| R224 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R225 | RES,METAL OXIDE,3.01K,1/4W, 1% | 07716 | CCA-T2 | 83097238 |
| R226 | NOT USED | | | |
| R227 | RES,METAL OXIDE,3.01K,1/4W, 1% | 07716 | CCA-T2 | 83097238 |
| R228 | RES,FIXED COMP,10 OHM,1/4W, 5% | 01121 | RC07GF100T | 83015001 |
| R229 | RES,FIXED COMP,10 OHM,1/4W, 5% | 01121 | RC07GF100T | 83015001 |
| R230 | RES,FIXED COMP,24K,1/4W, 5% | 01121 | RC07GF243T | 83015082 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R231 | RES,FIXED COMP,120K,1/4W, 5% | 01121 | RC07GF124J | 83015099 |
| R232 | RES,FIXED COMP,120K,1/4W, 5% | 01121 | RC07GF124J | 83015099 |
| R233 | RES,FIXED COMP,24K,1/4W, 5% | 01121 | RC07GF243J | 83015082 |
| R234 | RES,FIXED COMP,91K,1/4W, 5% | 01121 | RC07GF913J | 83015096 |
| R235 | RES,FIXED COMP,68K,1/4W, 5% | 01121 | RC07GF683J | 83015093 |
| R236 | NOT USED | | | |
| R237 | RES,FIXED COMP,100 OHM,1/4W, 5% | 01121 | RC07GF101J | 83015025 |
| R238 | RES,FIXED COMP,330 OHM,1/4W, 5% | 01121 | RC07GF331J | 83015037 |
| R239 | RES,FIXED COMP,1.2K,1/4W, 5% | 01121 | RC07GF122J | 83015051 |
| R240 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R241 | FIXED COMP,6800 OHM,1W, 5% | 01121 | RC07GF682J | 83015069 |
| R242 | RES,METAL OXIDE 100K,1/4W,1% | 07716 | CCA-T2 | 83097383 |
| R243 | RES,METAL FILM,100K,1/8W, 1% | 82142 | JC200 | 83098009 |
| R244 | RES,METAL FILM,100K,1/8W, 1% | 82142 | JC200 | 83098009 |
| R245 | RES,METAL FILM,100K,1/8W, 1% | 82142 | JC200 | 83098009 |
| R246 | RES,FIXED COMP,220 OHM,1/4W, 5% | 01121 | RC07GF221J | 83015033 |
| R247 | NOT USED | | | |
| R248 | RES,FIXED COMP,220 OHM,1/4W, 5% | 01121 | RC07GF221J | 83015033 |
| R249 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472J | 83015065 |
| R250 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472J | 83015065 |
| R251 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123J | 83015075 |
| R252 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R253 | RES,FIXED COMP,510 OHM,1/4W, 5% | 01121 | RC07GF511J | 83015042 |
| R254 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203J | 83015080 |
| R255 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103J | 83015073 |
| R256 | RES,FIXED COMP,220 OHM,1/4W, 5% | 01121 | RC07GF221J | 83015033 |
| R257 | RES,FIXED COMP,390 OHM,1/4W, 5% | 01121 | RC07GF391J | 83015039 |
| R258 | RES,FIXED COMP,680 OHM,1/4W, 5% | 01121 | RC07GF681J | 83015045 |
| R259 | RES,FIXED COMP,30K,1/4W, 5% | 01121 | RC07GF303J | 83015084 |
| R260 | RES,FIXED COMP,120K,1/4W, 5% | 01121 | RC07GF124J | 83015099 |
| R261 | RES,FIXED COMP,516K,1/4W, 5% | 01121 | RC07GF562J | 83015067 |

## TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R262 | RES,VARIABLE,100 OHM,1/2W, 20% | 30983 | ET34P101 | 83128004 |
| R263 | RES,FIXED COMP,51 OHM,1/4W, 5% | 01121 | RC07GF510T | 83015018 |
| R301 | RES,FIXED COMP,33K,1/4W, 5% | 01121 | RC07GF333T | 83015085 |
| R302 | RES,FIXED COMP,24K,1/4W, 5% | 01121 | RC07GF243T | 83015082 |
| R303 | RES,FIXED COMP,2K,1/4W, 5% | 01121 | RC07GF202T | 83015056 |
| R304 | RES,FIXED COMP,2K,1/4W, 5% | 01121 | RC07GF202T | 83015056 |
| R305 | RES,METAL OXIDE,1.37K,1/4W, 1% | 07716 | CCA-T2 | 83097205 |
| R306 | RES,METAL OXIDE,15K,1/4W, .1% | 07716 | CCA-T2 | 83097305 |
| R307 | RES,METAL OXIDE,1.87K,1/4W, 1% | 07716 | CCA-T2 | 83097218 |
| R308 | RES,METAL OXIDE,301K,1/4W, 1% | 07716 | CCA-T2 | 83097429 |
| R309 | RES,FIXED COMP,33K,1/4W, 5% | 01121 | RC07GF333T | 83015085 |
| R310 | RES,METAL OXIDE,49.9K,1/4W, 1% | 07716 | CCA-T2 | 83097354 |
| R311 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273T | 83015083 |
| R312 | RES,FIXED COMP,470 OHM,1/4W, 5% | 01121 | RC07GF471T | 83015041 |
| R313 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473T | 83015089 |
| R314 | NOT USED | | | |
| R315 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R316 | RES,200K,1/4W,5% | 01121 | RC07GF147T | 83015105 |
| R317 | RES,METAL OXIDE,75K,1/4W, 1% | 07716 | CCA-T2 | 83097371 |
| R318 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123T | 83015075 |
| R319 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R320 | RES,FIXED COMP,680 OHM,1/4W, 5% | 01121 | RC07GF681T | 83015045 |
| R321 | RES,METAL OXIDE,42.2K,1/4W, 1% | 07716 | CCA-T2 | 83097347 |
| R322 | RES,FIXED COMP,330 OHM,1/4W, 5% | 01121 | RC07GF331T | 83015037 |
| R323 | RES,METAL OXIDE,12.1K,1/8W, 1% | 07716 | CCA-T2 | 83097296 |
| R324 | RES,VARIABLE,2K,1/2W, 10% | 80294 | 3067P-1-202 | 83096006 |
| R325 | RES,METAL OXIDE,14K,1/4W, 1% | 07716 | CCA-T2 | 83097302 |
| R326 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R327 | FIXED COMP,680[illegible] OHM,1W, 5% | 01121 | RC07GF682T | 83015069 |
| R328 | RES,FIXED COMP,91K,1/4W, 5% | 01121 | RC07GF913T | 83015096 |
| R329 | RES,FIXED COMP,2K,1/8W, 5% | 01121 | RC07GF202T | 83015056 |

## TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R330 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R331 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R332 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R333 | RES,METAL OXIDE,8.25K,1/4W, 1% | 07716 | CCA-T2 | 83097280 |
| R334 | RES,4.3K,1/4W,5% | 01121 | RC07GF128T | 83015088 |
| R335 | RES,FIXED COMP,1 MEG,1/4W, 5% | 01121 | RC07GF105T | 83015121 |
| R336 | RES,VARIABLE,5K1/2W, 10% | 80294 | 3067P-1-502 | 83096007 |
| R337 | RES,METAL OXIDE,8.25K,1/4W, 1% | 07716 | CCA-T2 | 83097280 |
| R338 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R339 | RES,FIXED COMP,100 OHM,1/4W, 5% | 01121 | RC07GF101T | 83015025 |
| R340 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473T | 83015089 |
| R341 | RES,VARIABLE,2K,1/2W, 10% | 80294 | 3067P-1-202 | 83096006 |
| R342 | NOT USED | | | |
| R343 | NOT USED | | | |
| R344 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R345 | NOT USED | | | |
| R346 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273T | 83015083 |
| R347 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R348 | NOT USED | | | |
| R349 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R350 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R351 | RES,VARIABLE,2K,1/2W, 10% | 80294 | 3067P-1-202 | 83096006 |
| R352 | RES,FIXED COMP,430 OHM,1/4W, 5% | 01121 | RC07GF431T | 83015040 |
| R353 | NOT USED | | | |
| R354 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R355 | RES,FIXED COMP,22K,1/4W, 5% | 01121 | RC07GF223T | 83015081 |
| R356 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R357 | NOT USED | | | |
| R358 | NOT USED | | | |
| R359 | NOT USED | | | |
| R360 | RES,FIXED COMP,10K,1/4W, 5 | 01121 | RC07GF103T | 83015073 |

## TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R361 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R362 | RES,FIXED COMP,2.2K,1/4W, 5% | 01121 | RC07GF222T | 83015057 |
| R363 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R364 | RES,FIXED COMP,470 OHM,1/4W, 5% | 01121 | RC07GF471T | 83015041 |
| R365 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153T | 83015077 |
| R366 | RES,FIXED COMP,330 OHM,1/4W, 5% | 01121 | RC07GF331T | 83015037 |
| R367 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R368 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R369 | NOT USED | | | |
| R370 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R371 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R372 | RES,FIXED COMP,1.8K,1/4W, 5% | 01121 | RC07GF182T | 83015055 |
| R373 | RES,FIXED COMP,680 OHM,1/4W, 5% | 01121 | RC07GF681T | 83015045 |
| R374 | RES,FIXED COMP,390 OHM,1/4W, 5% | 01121 | RC07GF391T | 83015039 |
| R375 | RES,FIXED COMP,8.2K,1/4W, 5% | 01121 | RC07GF822T | 83015071 |
| R376 | RES,FIXED COMP 1.8K,1/4W,5% | 01121 | RC07GF182T | 83015055 |
| R377 | RES,FIXED COMP,330 OHM,1/4W, 5% | 01121 | RC07GF331T | 83015037 |
| R378 | RES,FIXED COMP,470 OHM,1/4W, 5% | 01121 | RC07GF471T | 83015041 |
| R379 | RES,FIXED COMP,22 OHM,1/4W, 5% | 01121 | RC07GF220T | 83015009 |
| R380 | RES,FIXED COMP,270 OHM,2W, 5% | 01121 | RC42GF271J | 83011035 |
| R381 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R382 | RES,METAL OXIDE 100K,1/4W,1% | 07716 | CCA-T2 | 83097383 |
| R383 | RES,METAL OXIDE 100K,1/4W,1% | 07716 | CCA-T2 | 83097383 |
| R384 | RES,FIXED COMP,220 OHM,1/4W, 5% | 01121 | RC07GF221T | 83015033 |
| R385 | RES,FIXED COMP,220 OHM,1/4W, 5% | 01121 | RC07GF221T | 83015033 |
| R386 | RES,FIXED COMP,470K,1/4W, 5% | 01121 | RC07GF474T | 83015113 |
| R387 | RES,VARIABLE,100K,1/2W, 10% | 30983 | FT54Y104 | 83096011 |
| R388 | RES,FIXED COMP,7500 OHM,1/4W, 5% | 01121 | RC07GF752T | 83015070 |
| R389 | RES,VARIABLE 1M,1/2W,5% | 30983 | FT34Y105 | 83096015 |
| R390 | RES,FIXED COMP 3.3M,1/4W,5% | 01121 | RC07GF335T | 83015133 |
| R391 | RES,FIXED COMP,11K,1/4W, 5% | 01121 | RC07GF113T | 83015074 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R392 | RES,FIXED COMP,10K,1/4W,5% | 01121 | RC07GF103T | 83015073 |
| R393 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104T | 83015097 |
| R394 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R395 | RES,FIXED COMP,1 MEG,1/4W, 5% | 01121 | RC07GF105T | 83015121 |
| R396 | RES,FIXED COMP,2.2K,1/4W, 5% | 01121 | RC07GF222T | 83015057 |
| R397 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R398 | RES,FIXED COMP,180 OHM,1/4W, 5% | 01121 | RC07GF181T | 83015031 |
| R392 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R399 | RES,FIXED COMP,33 OHM,1/4W, 5% | 01121 | RC07GF330T | 83015013 |
| R401 | RES,WIREWOUND,1.2 OHM,2W,5% | 11502 | BWH | 83034018 |
| R402 | RES,METAL OXIDE,511 OHM,1/4W, 1% | 07716 | CCA-T2 | 83097165 |
| R403 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R404 | RES,METAL OXIDE,1.24K,1/4W, 1% | 07716 | CCA-T2 | 83097201 |
| R405 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R406 | RES,METAL OXIDE,5.23K,1/4W, 1% | 07716 | CCA-T2 | 83097261 |
| R407 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R408 | RES,FIXED COMP,1K,1/4W,5% | 01121 | RC07GF102T | 83015049 |
| R409 | RES,MATCHED PAIR,1K/11K,1/8W, 1% | 24223 | 9848-2B | 83099001 |
| R410 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R411 | RES,MATCHED PAIR,1K/11K,1/8W, 1% | 24223 | 9848-2B | 83099001 |
| R412 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R413 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R414 | RES,FIXED COMP,100 OHM,1/4W, 5% | 01121 | RC07GF101T | 83015025 |
| R415 | RES,METAL OXIDE,511 OHM,1/4W, 1% | 07716 | CCA-T2 | 83097165 |
| R416 | RES,METAL OXIDE,1.24K,1/4W, 1% | 07716 | CCA-T2 | 83097201 |
| R417 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R418 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R419 | RES,METAL OXIDE,5.23K,1/4W, 1% | 07716 | CCA-T2 | 83097261 |
| R420 | RES,WIRE WOUND,1.5 OHM,2W, 5% | 75042 | BWH | 83034020 |
| R420 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R421 | RES,FIXED COMP,1K,1/4W,5% | 01121 | RC07GF102T | 83015049 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R422 | RES,FIXED COMP,2K,1/4W, 5% | 01121 | RC07GF202T | 83015056 |
| R423 | RES,MATCHED PAIR,20.5K/22.6K,1/8W, 1% | 24223 | 9848-2B | 83099002 |
| R424 | RES,VARIABLE,5K1/2W, 10% | 80294 | 3067P-1-502 | 83096007 |
| R425 | RES,MATCHED PAIR,20.5K/22.6K,1/8W, 1% | 24223 | 9848-2B | 83099002 |
| R426 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R427 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R429 | RES,FIXED COMP,75 OHM,2W, 5% | 01121 | RC42GF750J | 83011022 |
| R430 | RES,FIXED WIRE WOUND,39 OHM,5W, 5% | 11502 | RW57G390 | 83042063 |
| R501 | RES,MOLDED WIRE WOUND,4.3 OHM,2W, 5% | 75042 | BWH | 83034031 |
| R502 | RES,METAL OXIDE,4.64K,1/4W, 1% | 07716 | CCA-T2 | 83097256 |
| R503 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R504 | RES,METAL OXIDE,7.5K,1/4W, 1% | 07716 | CCA-T2 | 83097276 |
| R505 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R506 | RES,FIXED COMP,3K,1/4W, 5% | 01121 | RC07GF302T | 83015060 |
| R507 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R508 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R509 | RES,FIXED COMP,2.7K,1/4W, 5% | 01121 | RC07GF272T | 83015059 |
| R510 | RES,METAL OXIDE,7.5K,1/4W, 1% | 07716 | CCA-T2 | 83097276 |
| R511 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R512 | RES,METAL OXIDE,5.23K,1/4W, 1% | 07716 | CCA-T2 | 83097261 |
| R513 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R514 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R515 | RES,VARIABLE,1K1/2W, 10% | 80294 | 3067P-1-102 | 83096005 |
| R516 | RES,FIXED COMP,2.7K,1/4W, 5% | 01121 | RC07GF272T | 83015059 |
| R517 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332T | 83015061 |
| R518 | RES,FIXED COMP,2K,1/4W, 5% | 01121 | RC07GF202T | 83015056 |
| R519 | RES,FIXED COMP,220 OHM,1/4W, 5% | 01121 | RC07GF221T | 83015033 |
| R520 | RES,MOLDED WIRE WOUND,82 OHM,1W, 5% | 75042 | BWH | 83034014 |
| R521 | RES,FIXED COMP,220 OHM,1/4W, 5% | 01121 | RC07GF221T | 83015033 |
| R522 | RES,FIXED COMP,1.5K,1/4W, 5% | 01121 | RC07GF152T | 83015053 |
| R523 | RES,FIXED COMP,47 OHM,1/2W, 5% | 44655 | RC20GF470J | 83010017 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R524 | RES,FIXED COMP,820 OHM,1/2W, 5 | [illegible] | [illegible] | [illegible] |
| R525 | RES,FIXED COMP,33K,1/4W, 5% | 01121 | [illegible] | [illegible] |
| R526 | RES,18K,1/4W,5% | 01121 | RC07GF183J | [illegible] |
| R527 | RES,FIXED COMP,2K,1/4W, 5% | 01121 | RC07GF202J | 8301 5056 |
| R601 | RES,VARIABLE,200 OHM,1/2W, 20% | 30983 | ET34P201 | 8312 8005 |
| R602 | RES,VARIABLE,4.99K,1/4W, 1% | 82142 | JC200 | 8313 0025 |
| R603 | RES,VARIABLE,1K,1/2W, 20% | 30983 | ET34P102 | 8312 8007 |
| R604 | RES,VARIABLE,200K,1/2W,20% | 30983 | ET 34P204 | 8312 8014 |
| R605 | RES,VARIABLE,10K,1W,10% | 30983 | ET34P103-023 | 8312 8010 |
| R606 | RES,VARIABLE,200K,1/2W,20% | 30983 | ET 34P204 | 8312 8014 |
| R607 | RES,VARIABLE,10K,1W,10% | 30983 | ET34P103-023 | 8312 8010 |
| R608 | RES,VARIABLE,100K,3/4W, 10% | 80294 | 3009P-1-104 | 8312 8013 |
| R609 | RES,VARIABLE,100K,3/4W, 10% | 80294 | 3009P-1-104 | 8312 8013 |
| R610 | RES,VARIABLE,200K,1/2W,20% | 30983 | ET 34P204 | 8312 8014 |
| R611 | RES,VARIABLE,10K,1W,10% | 30983 | ET34P103-023 | 8312 8010 |
| R612 | RES,VARIABLE,200K,1/2W,20% | 30983 | ET 34P204 | 8312 8014 |
| R613 | RES,VARIABLE,10K,1W,10% | 30983 | ET34P103-023 | 8312 8010 |
| R614 | RES,VARIABLE,2K,1/2W, 20% | 30983 | ET34P202 | 8312 8008 |
| R615 | RES,VARIABLE,5K,1/2W, 20% | 30983 | ET34P502 | 8312 8009 |
| R616 | RES,VARIABLE,2K,1/2W, 20% | 30983 | ET34P202 | 8312 8008 |
| R617 | RES,VARIABLE,5K,1/2W, 20% | 30983 | ET34P502 | 8312 8009 |
| R618 | NOT USED | | | |
| R619 | NOT USED | | | |
| R620 | RES,FIXED COMP,39K,1/4W, 5% | 01121 | RC07GF393J | 8301 5083 |
| R621 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153J | [illegible] |
| R622 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472J | [illegible] |
| R623 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472J | 8301 5065 |
| R624 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473J | 8301 5085 |
| R625 | RES,FIXED COMP,150K,1/4W, 5% | 01121 | RC07GF154J | 8301 5101 |
| R626 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | [illegible] | [illegible] |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R627 | RES,FIXED COMP,68K,1/4W, 5% | 01121 | RC07GF683T | 83015093 |
| R628 | RES,FIXED COMP,200K,1/4W, 5% | 01121 | RC07GF204T | 83015104 |
| R629 | RES,FIXED COMP,470K,1/4W, 5% | 01121 | RC07GF474T | 83015113 |
| R630 | RES,FIXED COMP,2.4K,1/4W, 5% | 01121 | RC07GF242T | 83015058 |
| R631 | NOT USED | | | |
| R632 | RES,FIXED COMP,39K,1/4W, 5% | 01121 | RC07GF393T | 83015087 |
| R633 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153T | 83015077 |
| R634 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R635 | NOT USED | | | |
| R636 | RES,FIXED COMP,39K,1/4W, 5% | 01121 | RC07GF393T | 83015087 |
| R637 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153T | 83015077 |
| R638 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R639 | RES,FIXED COMP,620 OHM,1/4W, 5% | 01121 | RC07GF621T | 83015044 |
| R640 | NOT USED | | | |
| R641 | RES,FIXED COMP,22K,1/4W, 5% | 01121 | RC07GF223T | 83015081 |
| R642 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153T | 83015077 |
| R643 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R644 | RES,FIXED COMP,33K,1/4W, 5% | 01121 | RC07GF333T | 83015085 |
| R645 | RES,FIXED COMP,33K,1/4W, 5% | 01121 | RC07GF333T | 83015085 |
| R646 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473T | 83015089 |
| R647 | RES,METAL FILM,12.25K,1/4W, 5% | 82142 | JC-200 | 83130013 |
| R648 | RES,METAL FILM,350 OHM,1/4W, 5% | 82142 | JC-200 | 83130001 |
| R649 | RES,METAL FILM,9.09K,1/4W, 1% | 82142 | JC-200 | 83130010 |
| R650 | RES,METAL FILM,40.2K,1/4W, 5% | 82142 | JC-200 | 83130017 |
| | FIXED COMP,1K,1/4W,5% | 01121 | RC07GF102T | 83015045 |
| | RES,METAL FILM,6.04K,1/4W, 5% | 82142 | JC-200 | 83130005 |
| | RES,METAL FILM,6.04K,1/4W, 5% | 82142 | JC-200 | 83130005 |
| R655 | NOT USED | | | |
| R656 | NOT USED | | | |
| R657 | NOT USED | | | |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R658 | NOT USED | | | |
| R659 | RES,VARIABLE,4.99K,1/4W, 1% | 82142 | JC260 | 83130025 |
| R660 | RES,VARIABLE,100K,3/4W, 10% | 80294 | 3009P-1-104 | 83128010 |
| R661 | RES,VARIABLE,2K, 10% | 30983 | RJ24X103 | 83147001 |
| R662 | RES,FIXED COMP,100K,1/4W, 5% | 01121 | RC07GF104J | 83015097 |
| R663 | RES,FIXED COMP,2K,1/4W, 5% | 01121 | RC07GF202J | 83015056 |
| R664 | RES,FIXED COMP,3K,1/4W, 5% | 01121 | RC07GF302J | 83015060 |
| R665 | NOT USED | | | |
| R666 | NOT USED | | | |
| R667 | NOT USED | | | |
| R668 | NOT USED | | | |
| R669 | NOT USED | | | |
| R670 | NOT USED | | | |
| R671 | NOT USED | | | |
| R672 | RES,VARIABLE,50K,3/4W, 10% | 80294 | 3009P-1-503 | 83128012 |
| R673 | RES,VARIABLE,2K,1/2W, 20% | 30983 | ET34P202 | 83128008 |
| R674 | RES,FIXED COMP,6.2K,1/4W, 5% | 01121 | RC07GF622J | 83015068 |
| R675 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103J | 83015073 |
| R676 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203J | 83015080 |
| R677 | RES,FIXED COMP,1K,1/4W,5% | 01121 | RC07GF102J | 83015049 |
| R678 | RES,FIXED COMP,510K,1/4W, 5% | 01121 | RC07GF562J | 83015067 |
| R679 | RES,FIXED COMP,1 MEG,1/4W, 5% | 01121 | RC07GF105J | 83015121 |
| R680 | RES,FIXED COMP,1 MEG,1/4W, 5% | 01121 | RC07GF105J | 83015121 |
| R681 | RES,FIXED COMP,1 MEG,1/4W, 5% | 01121 | RC07GF105J | 83015121 |
| R682 | RES,FIXED COMP,3.3K,1/4W, 5% | 01121 | RC07GF332J | 83015061 |
| R683 | RES,FIXED COMP,1 MEG,1/4W,5% | 01121 | RC07GF105J | 83015121 |
| R701 | RES,METAL FILM,1.688K,1/4W, 5% | 82142 | JC-200 | 83130020 |
| R702 | RES,METAL FILM,40.2K,1/4W, 5% | 82142 | JC-200 | 83130017 |
| R703 | RES,METAL FILM,10.5K,1/4W, 5% | 82142 | JC-200 | 83130012 |
| R704 | RES,METAL FILM,2.0K,1/4W, 5% | 82142 | JC-200 | [illegible] |
| R705 | RES,METAL FILM,40.2K,1/4W, 5% | 82142 | JC-200 | [illegible] |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R706 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | [illegible] |
| R707 | RES,FIXED COMP,22M,1/4W, 5% | 01121 | RC07GF226T | 83015153 |
| R708 | RES,FIXED COMP,22M,1/4W, 5% | 01121 | RC07GF226T | 83015153 |
| R709 | RES,METAL FILM,40.2K,1/4W, 5% | 82142 | JC-200 | 83130017 |
| R710 | RES,METAL FILM,40.2K,1/4W, 5% | 82142 | JC-200 | 83130017 |
| R711 | NOT USED | | | |
| R712 | NOT USED | | | |
| R713 | RES,MAT PR,12.55K,1/8W,1%250 OHM,1/8W,1% | 24223 | 9848-28 | 83099003 |
| R714 | RES,METAL FILM,836 OHM,1/4W, 5% | 82142 | JC-200 | 83130003 |
| R715 | RES,MAT PR,12.55K,1/8W,1%250 OHM,1/8W,1% | 24223 | 9848-28 | 83099003 |
| R716 | RES,METAL FILM,4.675K,1/4W, 5% | 82142 | JC-200 | 83130008 |
| R717 | RES,METAL FILM,40.2K,1/4W, 5% | 82142 | JC-200 | 83130017 |
| R718 | NOT USED | | | |
| R719 | RES,METAL FILM,6.04K,1/4W, 5% | 82142 | JC-200 | 83130009 |
| R720 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R721 | RES,METAL FILM,6.04K,1/4W, 5% | 82142 | JC-200 | 83130009 |
| R722 | RES,FIXED COMP,6.2K,1/4W, 5% | 01121 | RC07GF622T | 83015068 |
| R723 | RES,VARIABLE,10K,1W,10% | 30983 | ET34P103-023 | 83128010 |
| R724 | RES,VARIABLE,50K,3/4W, 10% | 80294 | 3009P-1-503 | 83128012 |
| R725 | RES,VARIABLE,20K,1/2W, 20% | 30983 | ET34P203 | 83128011 |
| R726 | RES,VARIABLE,50K,3/4W, 10% | 80294 | 3009P-1-503 | 83128012 |
| R727 | RES,VARIABLE,50K,3/4W, 10% | 80294 | 3009P-1-503 | 83128012 |
| R728 | RES,VARIABLE,10K,1W,10% | 30983 | ET34P103-023 | 83128010 |
| R729 | RES,VARIABLE,1K,1/2W, 20% | 30983 | ET34P102 | 83128007 |
| R730 | RES,VARIABLE,500 OHMS,1/2W,20% | 30983 | ET34P501-023 | 83128006 |
| R731 | RES,VARIABLE,500 OHMS,1/2W,20% | 30983 | ET34P501-023 | 83128006 |
| R732 | RES,VARIABLE,100 OHM,1/2W, 20% | 30983 | ET34P101 | 83128004 |
| R733 | RES,VARIABLE,50 OHM,1/2W, 20% | 30983 | ET34P500 | 83128003 |
| R734 | RES,VARIABLE,20K,1/2W, 20% | 30983 | ET34P203 | 83128011 |
| R735 | RES,VARIABLE,20K,1/2W, 20% | 30983 | ET34P203 | 83128011 |
| R736 | RES,VARIABLE,20K,1/2W, 20% | 30983 | ET34P203 | 83128011 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R737 | RES,MET FILM,[illegible] | 80983 | [illegible] | 83129011 |
| R738 | RES,METAL FILM,[illegible] | 82142 | JC-200 | 83130013 |
| R739 | RES,METAL FILM,[illegible] | 82142 | JC-200 | 83130016 |
| R740 | RES,METAL FILM,30.9K,1/4W, 1% | 82142 | JC-200 | 83130016 |
| R741 | RES,METAL FILM,61.9K,1/4W, 1% | 82142 | JC-200 | 83130019 |
| R742 | RES,METAL FILM,61.9K,1/4W, 1% | 82142 | JC-200 | 83130019 |
| R743 | RES,METAL FILM,8.06K,1/4W, 1% | 82142 | JC-200 | 83130023 |
| R744 | RES,METAL FILM,5.49K,1/4W, 1% | 82142 | JC-200 | 83130024 |
| R745 | RES,METAL FILM,2.37K,1/4W, 1% | 82142 | JC-200 | 83130006 |
| R746 | RES,METAL FILM,1.91K,1/4W, 1% | 82142 | JC-200 | 83130004 |
| R747 | RES,METAL FILM,634 OHM,1/4W, 1% | 82142 | JC-200 | 83130002 |
| R748 | RES,FIXED COMP,6.2K,1/4W, 5% | 01121 | RC07GF622T | 83015068 |
| R749 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203T | 83015080 |
| R750 | RES,FIXED COMP,6.2K,1/4W, 5% | 01121 | RC07GF622T | 83015068 |
| R751 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203T | 83015080 |
| R752 | RES,FIXED COMP,3K,1/4W, 5% | 01121 | RC07GF302T | 83015060 |
| R753 | RES,FIXED COMP,4.7K,1/4W, 5% | 01121 | RC07GF472T | 83015065 |
| R754 | RES,FIXED COMP,4.7M,1/4W, 5% | 01121 | RC07GF475T | 83015137 |
| R755 | RES,FIXED COMP,4.7M,1/4W, 5% | 01121 | RC07GF475T | 83015137 |
| R756 | RES,FIXED COMP,4.7M,1/4W, 5% | 01121 | RC07GF475T | 83015137 |
| R757 | RES,FIXED COMP,4.7M,1/4W, 5% | 01121 | RC07GF475T | 83015137 |
| R758 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203T | 83015080 |
| R759 | RES,FIXED COMP,91K,1/4W, 5% | 01121 | RC07GF913T | 83015096 |
| R760 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R761 | RES,FIXED COMP,62K,1/4W, 5% | 01121 | RC07GF623T | 83015092 |
| R762 | RES,FIXED COMP,39K,1/4W, 5% | 01121 | RC07GF393T | 83015087 |
| R763 | RES,FIXED COMP,39K,1/4W, 5% | 01121 | RC07GF393T | 83015087 |
| R764 | RES,FIXED COMP,62K,1/4W, 5% | 01121 | RC07GF623T | 83015092 |
| R765 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273T | 83015083 |
| R766 | RES,FIXED COMP,68K,1/4W, 5% | 01121 | RC07GF683T | 83015093 |
| R767 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203T | [illegible] |

## TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R765 | RES,FIXED COMP,150K,1/4W, 5% | 01121 | RC07GF154J | 83015101 |
| R766 | NOT USED | | | |
| R801 | RES,METAL FILM,13K,1/4W, 1% | 07716 | CCA-T2 | 83098003 |
| R802 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R803 | RES,FIXED COMP,1.2K,1/4W, 5% | 01121 | RC07GF122J | 83015051 |
| R804 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R805 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R806 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R807 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R808 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R809 | RES,FIXED COMP,330 OHM,1/4W, 5% | 01121 | RC07GF331J | 83015037 |
| R810 | RES,FIXED COMP,1K,1/8W,5% | 07716 | CCA-T2 | 83097192 |
| R811 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203J | 83015080 |
| R812 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153J | 83015077 |
| R813 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123J | 83015075 |
| R814 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153J | 83015077 |
| R815 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123J | 83015075 |
| R816 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153J | 83015077 |
| R817 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123J | 83015075 |
| R818 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203J | 83015080 |
| R819 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123J | 83015075 |
| R820 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R821 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R822 | RES,FIXED COMP,390 OHM,1/4W, 5% | 01121 | RC07GF391J | 83015039 |
| R823 | NOT USED | | | |
| R824 | NOT USED | | | |
| R825 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R826 | RES,FIXED COMP,27K,1/4W, 5% | 01121 | RC07GF273J | 83015083 |
| R827 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203J | 83015080 |
| R828 | RES,FIXED COMP,15K,1/4W, 5% | 01121 | RC07GF153J | 83015077 |
| R829 | RES,FIXED COMP,1 MEG,1/4W, 5% | 01121 | RC07GF105J | 83015121 |

## TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R901 | RES,VARIABLE,10K1/2W, 10% | 80294 | 3067P-1-101 | 83096008 |
| R902 | RES,VARIABLE,10K1/2W, 10% | 80294 | 3067P-1-101 | 83096008 |
| R903 | RES,VARIABLE,10K1/2W, 10% | 80294 | 3067P-1-101 | 83096008 |
| R904 | RES,VARIABLE,10K1/2W, 10% | 80294 | 3067P-1-101 | 83096008 |
| R1001 | RES,POWER PRECISION,15 OHM, 1% | 00213 | 3010M-15-1 | 83129002 |
| R1002 | RES,FIXED COMP,68 OHM,2W, 5% | 01121 | RC42GF680J | 83011021 |
| R1003 | RES,VARIABLE,100 OHM,2W, 10% | 01121 | 0405101UC | 83056201 |
| R1004 | RES,METAL FILM,5 OHM,10W, 1% | 00213 | 3010M-5-1 | 83129001 |
| R1101 | RES,FIXED COMP 1K,1/4W,5% | 16299 | C410005 | 83050049 |
| R1102 | RES,FIXED COMP,20K,1/4W, 5% | 01121 | RC07GF203T | 83015080 |
| R1103 | RES,FIXED COMP,22 OHM,1W, 5% | 01121 | RC32GF220J | 83014009 |
| R1104 | RES,FIXED COMP,22 OHM,1W, 5% | 01121 | RC32GF220J | 83014009 |
| R1105 | RES,VARIABLE,10 OHM,2W, 20% | 11236 | 115 | 83061109 |
| R1106 | RES,FIXED COMP,10K,1/4W, 5% | 01121 | RC07GF103T | 83015073 |
| R1107 | RES,FIXED COMP,22 OHM,1/4W, 5% | 01121 | RC07GF220T | 83015009 |
| R1108 | RES,FIXED COMP,2.2K,1/4W, 5% | 01121 | RC07GF222T | 83015057 |
| R1109 | RES,FIXED COMP,5.1K,1/4W, 5% | 01121 | RC07GF512T | 83015066 |
| R1110 | RES,FIXED COMP,82 OHM,1/2W, 5% | 44655 | RC20GF820J | 83010023 |
| R1111 | RES,FIXED COMP,39 OHM,1W, 5% | 01121 | RC32GF390J | 83014015 |
| R1112 | NOT USED | | | |
| R1113 | NOT USED | | | |
| R1114 | NOT USED | | | |
| R1115 | NOT USED | | | |
| R1116 | NOT USED | | | |
| R1117 | NOT USED | | | |
| R1118 | NOT USED | | | |
| R1119 | RES,VARIABLE,10 OHM,1W, 5% | 80294 | M0D100 | 83067006 |
| R1120 | RES,VARIABLE,10 OHM,1W, 5% | 80294 | M0D100 | 83067006 |
| R1121 | NOT USED | | | |
| R1122 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473T | 83015089 |
| R1123 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473T | 83015089 |

TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| R1124 | NOT USED | | | |
| R1125 | NOT USED | | | |
| R1126 | NOT USED | | | |
| R1127 | NOT USED | | | |
| R1128 | NOT USED | | | |
| R1129 | NOT USED | | | |
| R1130 | RES,FIXED COMP,12K,1/4W, 5% | 01121 | RC07GF123T | 83015075 |
| R1131 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473T | 83015089 |
| R1132 | RES,VARIABLE,1.2K,1/2W,5% | 80294 | 3365P-1-102 | 83067008 |
| R1133 | RES,FIXED COMP,330 OHMS,1/4W,5% | 01121 | RC07GF331T | 83015037 |
| R1134 | RES,FIXED COMP,47K,1/4W, 5% | 01121 | RC07GF473T | 83015089 |
| R1135 | RES,FIXED COMP,2.2M,1/4W, 5% | 01121 | RC07GF225T | 83015129 |
| R1136 | RES,FIXED COMP,220 OHM,1/4W, 5% | 01121 | RC07GF221T | 83015033 |
| R1137 | RES,FIXED COMP,180 OHM,1/4W, 5% | 01121 | RC07GF181T | 83015031 |
| R1138 | RES,FIXED COMP,120 OHM,1/4W, 5% | 01121 | RC07GF121T | 83015027 |
| R1139 | RES,FIXED COMP,120 OHM,1/4W, 5% | 01121 | RC07GF121T | 83015027 |
| R1140 | RES,FIXED COMP,33 OHM,1/4W, 5% | 01121 | RC07GF330T | 83015013 |
| R1141 | RES,FIXED COMP,1.2K,1/4W, 5% | 01121 | RC07GF122T | 83015051 |
| R1142 | RES,FIXED COMP 15K,1/4W,5% | 01121 | RC07GF153T | 83015077 |
| R1143 | RES,FIXED COMP 15K,1/4W,5% | 01121 | RC07GF153T | 83015077 |
| S1 | SWITCH,SELECTOR | 71450 | 226-22636-1 | 83542000 |
| S2 | SWITCH,SELECTOR | 71450 | 226-22637-1 | 83538000 |
| S3 | SLIDE SWITCH | 82349 | 4620GL | 83510001 |
| S4 | SWITCH,SELECTOR | 71450 | 226-22638-1 | 83540000 |
| S5 | SWITCH,SELECTOR | 71450 | 226-22639-1 | 83539000 |
| S6 | RES,VARIABLE,1000 OHM,1K, 10% | 01121 | JP0T | 83103000 |
| S7 | SWITCH BUTTON | 82349 | 933 | 83536000 |
| S8 | SWITCH SLIDE 115-230 VOLTS | 82349 | 46206LF | 83509001 |
| S9 | SWITCH TOGGLE | 15605 | 8373K7 | 83508001 |
| S10 | PART OF S17 | | | |

## TABLE 5-2. REPLACEABLE PARTS LIST (CONT)

| REF. DESIG. | DESCRIPTION | MFG. CODE | MFG. PART NO. | NARDA PART NO. |
|---|---|---|---|---|
| S11 | SWITCH BUTTON | 82349 | 933 | 83536000 |
| S20 | THERMOSTAT | 14604 | 3001 | 83569000 |
| S21 | SWITCH,MINIATURE | 95146 | MST-205-N | 83567000 |
| S801-8 | SWITCH,ILLUM,PUSH BUTTON | 72619 | 513-0101-604 | 83535000 |
| T1 | TRANSFORMER | 83008 | 99899 | 84014000 |
| TB1001 | TERMINAL BLOCK | 75382 | 600A-8 | 80622004 |
| TB1002 | TERMINAL BLOCK | 75382 | 600A-8 | 80622004 |

# SECTION VI

# SCHEMATIC DIAGRAMS

6-1. GENERAL.

6-2. This section provides the complete set of schematic diagrams required for maintenance of the Narda Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR.

6-3. INSTRUCTIONS FOR CONNECTOR WIRING DATA.

6-4. To trace the signals from the connector through the main printed wiring board, referred to as the mother board, a wiring diagram has been included on the apron of each schematic diagram. These wiring diagrams trace the signals and voltages from the circuit card, whether it is on the connector or a wired point, to the next significant point. In the case of voltages, this will be a tie point on the mother board. For signals, a significant point will be a switch, another board, a jack, or a component on the mother board.

6-5. For the 100, 200, 300, 400 and 500 boards, under the plug number, the first column on the left, each connected pin is listed. The next number on the right is the component, terminal board, or tie point on the mother board to which the pin is connected by printed wiring. Where the connection is made to a tie point, the last set of numbers represent the connector, switch, etc., to which the tie point is wired.

6-6. For the 600, 700, 800 and 900 boards, and connector P1001, the same basic system as described in the above paragraph is used, with the exception that these boards are first wired and then connected through the mother board. Therefore, the first set of numbers represent the connector points; the second set of numbers represent the points to which the connector is hard wired. Then if this is a tie point on the mother board, the connections are through printed wiring on the mother board. The 600 and 700 boards have four wires which are directly wired from board to board. These wires are listed below the terminal board points.

6-7. The following schematics and printed circuit board component location illustrations are included in this manual.

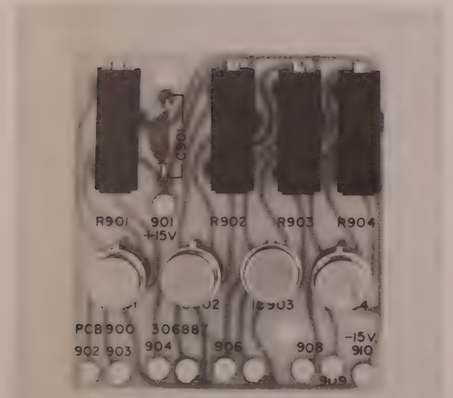
| Title | Circuits | Figure No. |
|---|---|---|
| a. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER/SIGNAL GENERATOR Functional Interconnection Drawing and Printed Circuit Board Number 900 photograph. | | 6-1 |
| b. Printed Circuit Board Number 100 Schematic Diagram and photograph. | Sweep Generator<br>High and Low Limit Detectors<br>Control Multivibrators | 6-2 |
| c. Printed Circuit Board Number 200 Schematic Diagram and photograph. | Summing Amplifier<br>Marker Generator<br>Blanking Generator<br>Sweep Rate Limiter | 6-3 |

| Title | Circuits | Figure No. |
|---|---|---|
| d. Printed Circuit Board Number 300 Schematic Diagram and photograph. | Schmitt Trigger<br>Square Wave Generator<br>Modulation Summing Amplifier<br>Leveler Amplifier<br>Meter Calibration<br>Diode Switch Driver | 6-4 |
| e. Printed Circuit Board Number 400 Schematic Diagram and photograph. | ±13V and ±15V Power Supplies | 6-5 |
| f. Printed Circuit Board Number 500 Schematic Diagram and photograph. | +28V, -22V, and -6V Power Supplies | 6-6 |
| g. Printed Circuit Board Number 600 Schematic Diagram and photograph. | Oscillator Driver | 6-7 |
| h. Printed Circuit Board Number 700 Schematic Diagram and photograph. | Multiplier Driver | 6-8 |
| i. Printed Circuit Board Number 800 Schematic Diagram and photograph. | Relay Board<br>Switching Logic | 6-9 |
| j. RF Section Schematic Diagram and Printed Circuit Board Number 1100 photograph. | 1 Watt Amplifier Leveler and 2 GHz crossover Diode Switch Driver | 6-10 |
| k. Digital Display Counter Schematic Diagram. | | 6-11 |

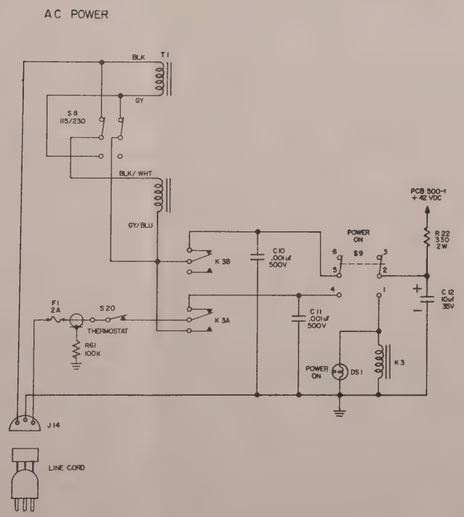
6-8. All resistors are 1/4 watt ±5% and are shown in ohms unless otherwise specified.

6-9. Circuits contained in dashed lines are related to circuitry on respective boards but not located on that board.

6-10. Components contained in dotted lines are single assemblies.




| PCB900 | WIRED TO | TERM | |
|---|---|---|---|
| 901 | | 27A | +15V |
| 902 | P801-26 | | |
| 903 | R42-4 | | |
| 904 | P801-22 | | |
| 905 | R41-4 | | |
| 906 | P801-54 | | |
| 907 | R40-4 | | |
| 908 | P801-48 | | |
| 909 | R39-4 | | |
| 910 | | 33A | -15V |



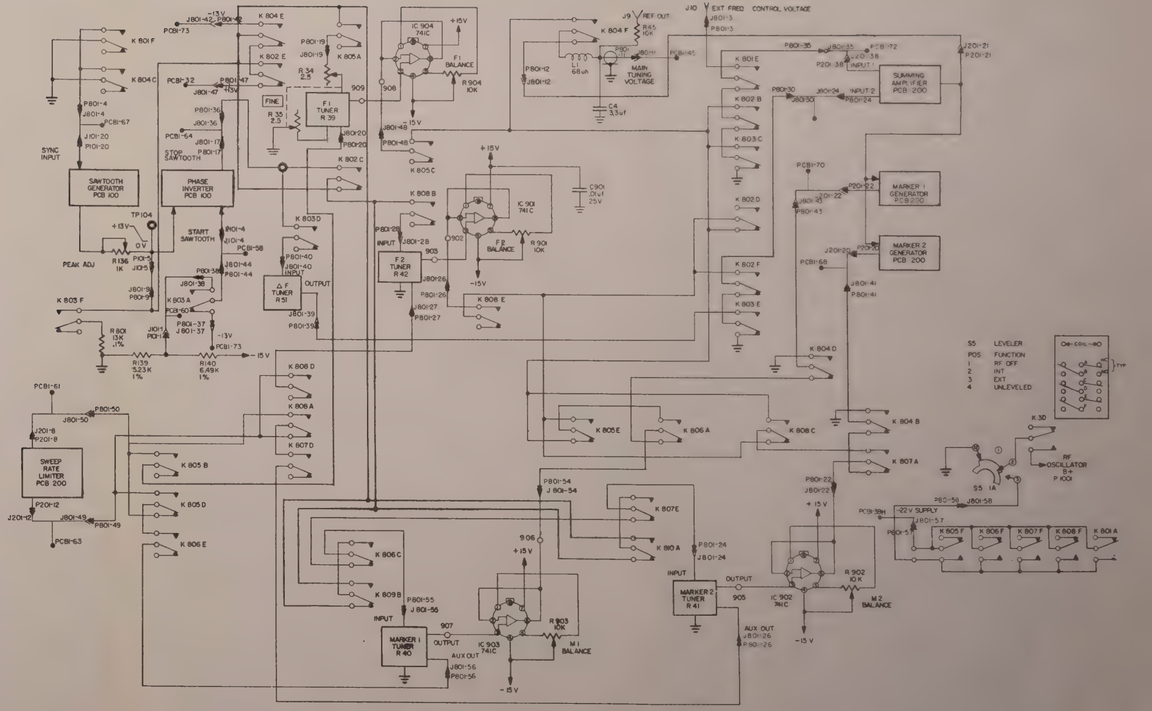
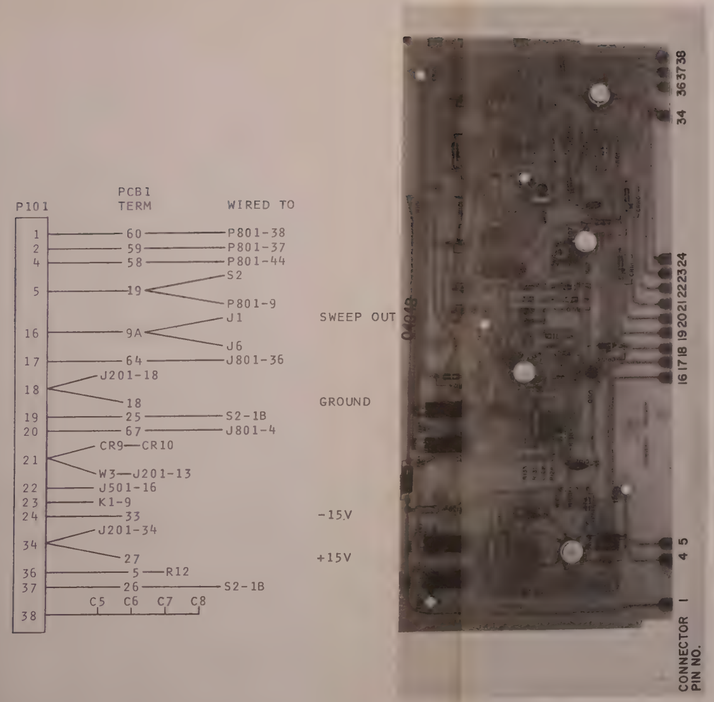




Figure 6-1. Model 9500 1.0 - 12.4 GHz SOLID STATE SWEEPER Functional Interconnection Drawing and Printed Circuit Board Number 900 photograph



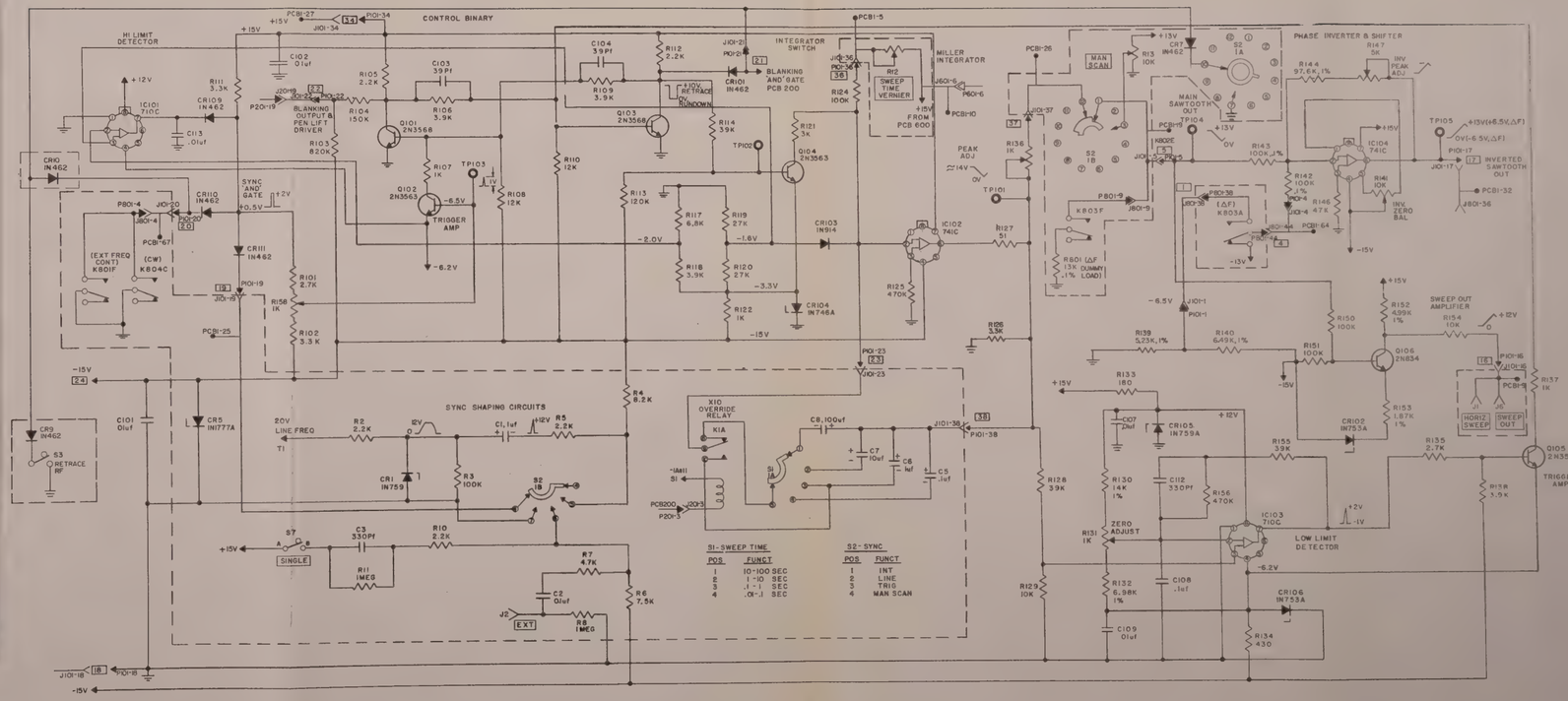
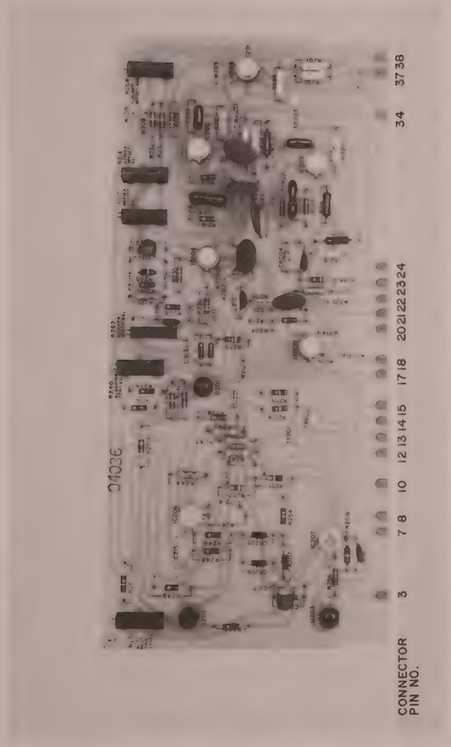




Figure 6-2. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Printed Circuit Board Number 100 Schematic Diagram and photograph.

| P201 | PCB1 TERM | WIRED TO | |
|---|---|---|---|
| 3 | 7 (K1) | DS2 | |
| 7 | | | GROUND |
| 8 | 61 | P801-50 | |
| 10 | 62 | | SPARE |
| 12 | 63 | P801-49 | |
| 13 | W3 — CR9 — CR10 | P101-21 | |
| 14 | | P301-5 | |
| 15 | R24-1 31B | J5 | MARKER OUTPUT |
| 17 | 28 — R17-3 | | |
| 18 | P101-18 | | GROUND |
| 20 | 68 | P801-41 | |
| 21 | 69 | P801-12 | |
| 22 | 70 | P801-43 | |
| 23 | 29 — R17 1 & 2 | | |
| 24 | 33 | | -15V |
| 34 | 27 | P101-34 | +15V |
| 37 | 71 | P801-30 | |
| 38 | 72 | P801-35 | |



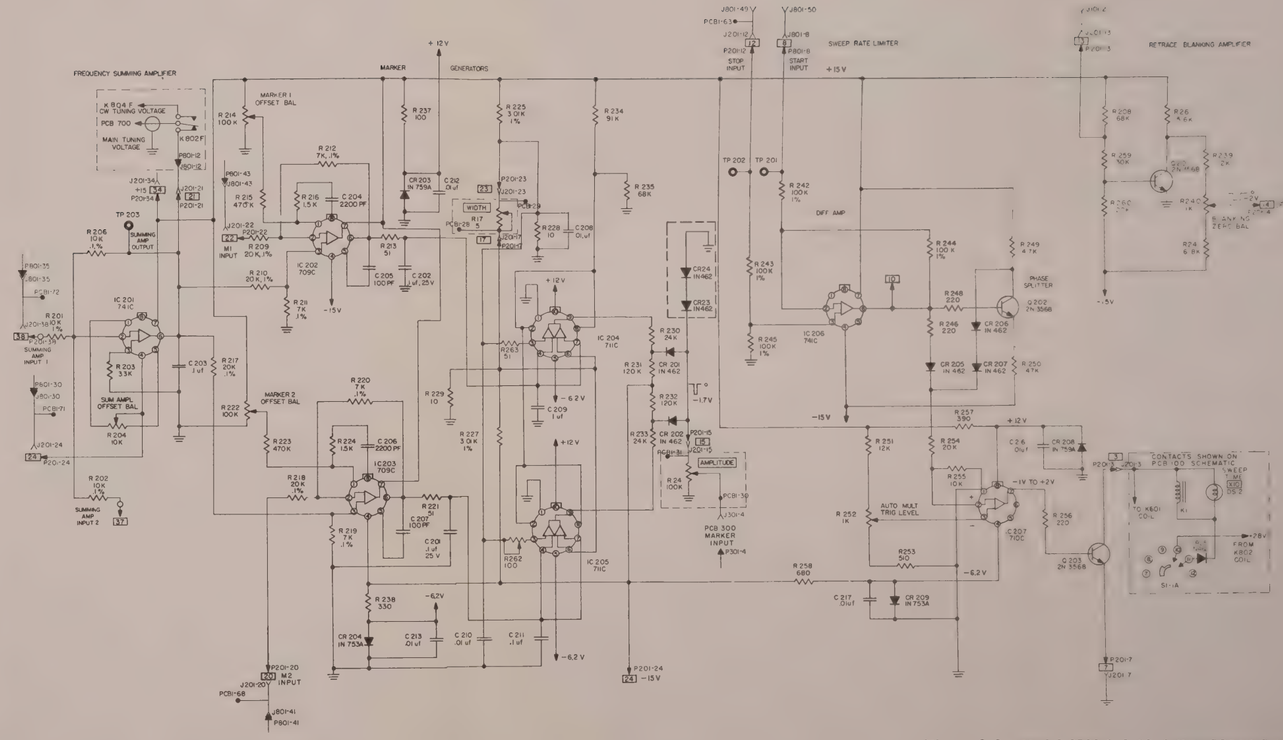
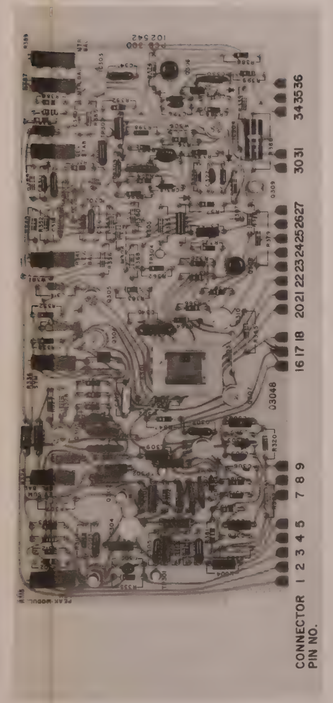




Figure 6-3. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Printed Circuit Board Number 200 Schematic Diagram and photograph.

| P301 | TERM | WIRED TO | |
|---|---|---|---|
| 1 | 44 | S4 | |
| 2 | 48 | S4 | |
| 3 | 43 | S4 | |
| 4 | 30 — R24-2 | | MARKER INPUT |
| 5 | J201-14 | | |
| 7 | 10 | J601-F, J20 | |
| 8 | 42 | S4 | |
| 9 | 33 | | -15V |
| 16 | 74 | | |
| 17 | 41 | S4 | |
| 18 | P201-18 | | GROUND |
| 20 | 40 — R23 | | |
| 21 | | | GROUND |
| 22 | 118 | S5-1B | |
| 23 | W4 — 50 | TO BROADBAND SWITCH | |
| 24 | 33 | | -15V |
| 25 | 52 | S5 | |
| 26 | 55 — R43 & S6 | | |
| 27 | 39 | S5 | |
| 30 | | | GROUND |
| 31 | 51 — DS3 | | |
| 34 | 27 | | +15V |
| 35 | 36 | S5 | |
| 36 | 37 | M1 | |



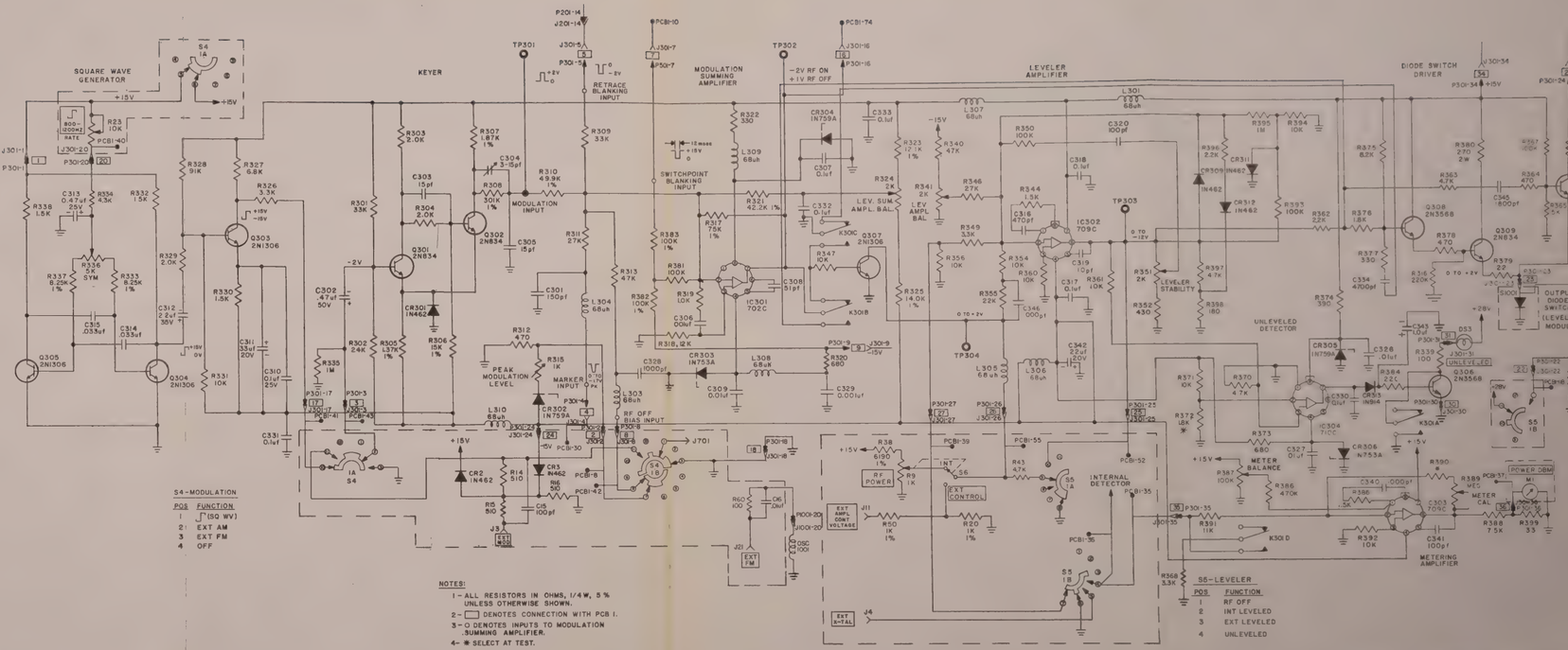
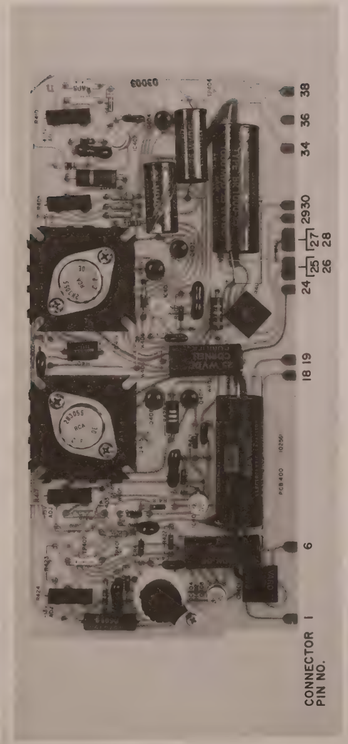




Figure 6-4. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Printed Circuit Board Number 300 Schematic Diagram and photograph.

| P401 | TERM | WIRED TO | |
|---|---|---|---|
| 1 | 84 — T1 | | |
| 6 | 85 — T1 | | |
| 18 | 80 | | GROUND D |
| 19 | 73 | P401-42 | -13V OUTPUT |
| 24 | 33A & 33B | | -15V OUTPUT |
| 25 | 77 | | -28V GROUND RETURN |
| 26 | | | |
| 27 | 78A & 78B | | GROUND |
| 28 | | | |
| 29 | 93 — T1 | | |
| 30 | 94 — T1 | | |
| 34 | 27A & 27B | | +15V OUTPUT |
| 36 | 32A & 32B | | +13V OUTPUT |
| 38 | 4A & 4B | | +28V OUTPUT |



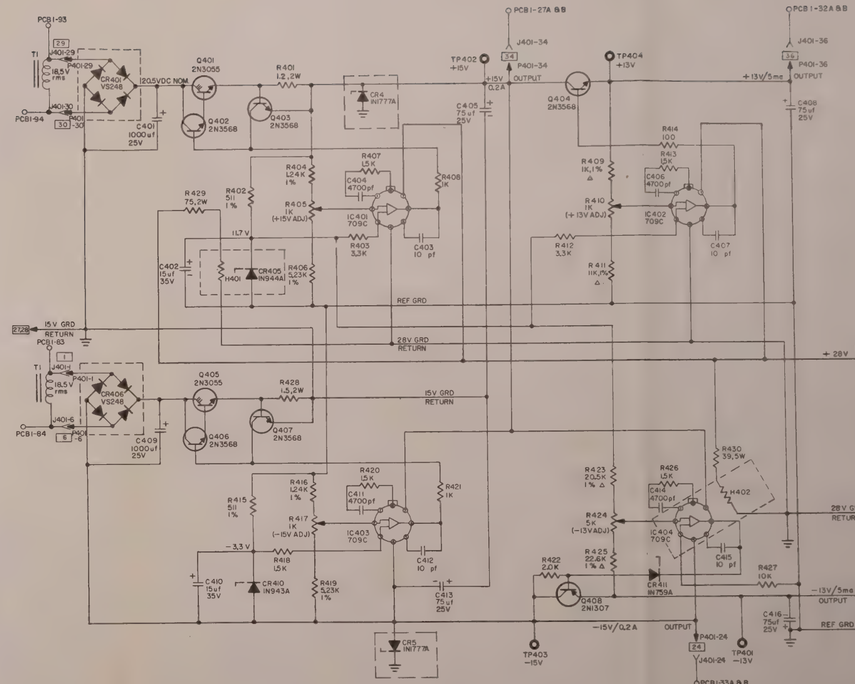
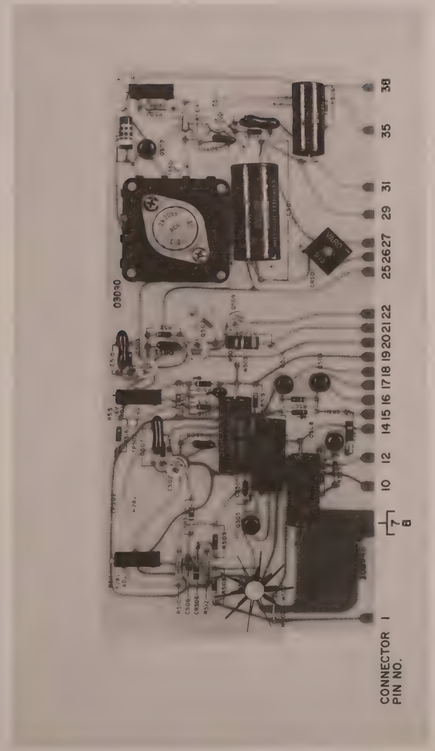




Figure 6-5. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Printed Circuit Board Number 400 Schematic Diagram and photograph.

| P501 | TERM | WIRED TO | |
|---|---|---|---|
| 1 | 83 | C9 R48 K4 | +42V OUTPUT |
| 7 | | | GROUND |
| 8 | | | |
| 10 | 88 | Q1-B | |
| 12 | 89 | Q1-E | |
| 14 | 4A | | +28V OUTPUT |
| 15 | | Q3-B | |
| 16 | P101-22 | | |
| 17 | 27 | | +15V |
| 18 | 81A | S1, DS4, J7 | |
| 19 | 97 | 108 — P1001-7 | |
| 20 | 98 | 109 — Q2-B | |
| 21 | CR15 | | |
| 22 | 114 | Q2-E | |
| 25 | 33A | | -15V OUTPUT |
| 26 | 91 | T1 | |
| 27 | 92 | T1 | |
| 29 | 38 | | -22V OUTPUT |
| 31 | 27A | | +15V OUTPUT |
| 35 | W11 — W5 — 27A | | +13V |
| 38 | 46 | | GROUND |



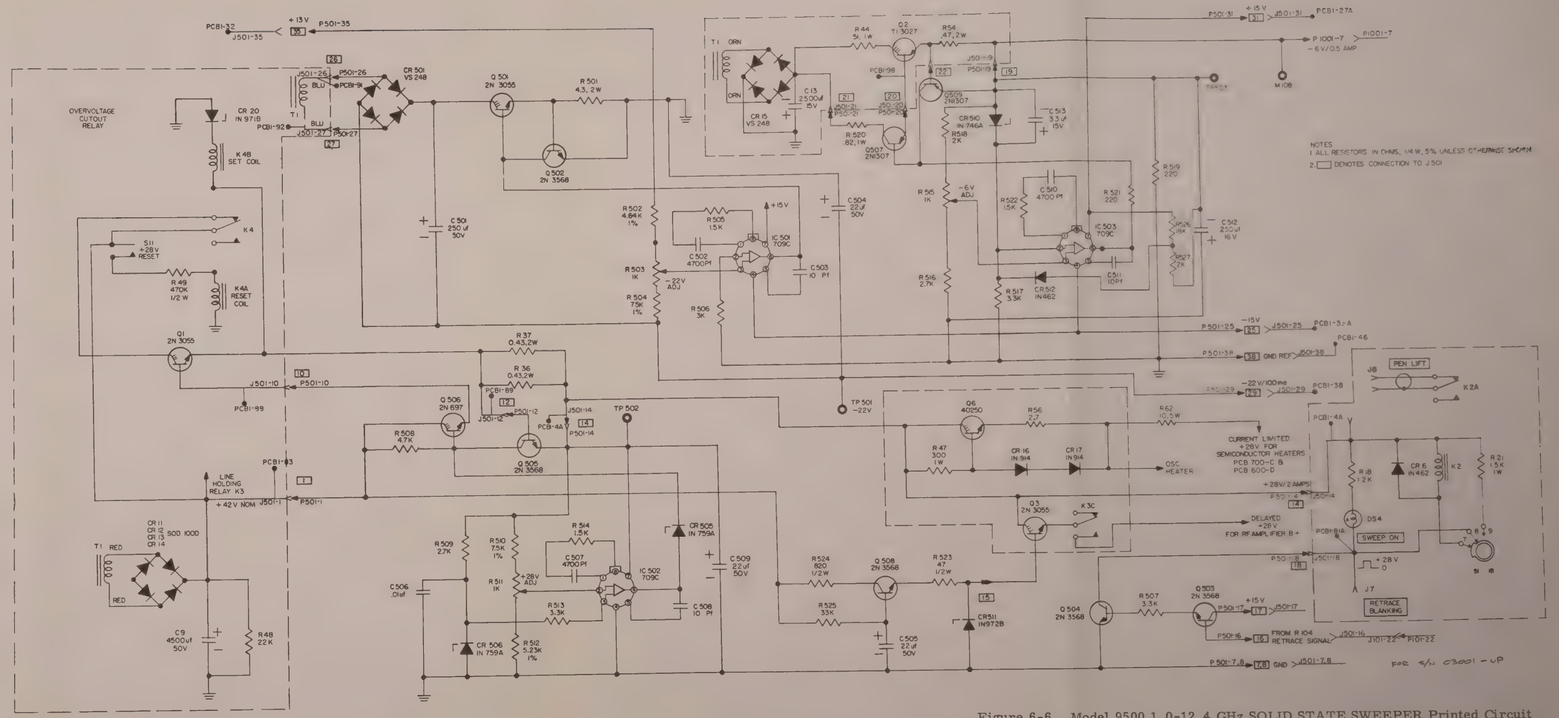
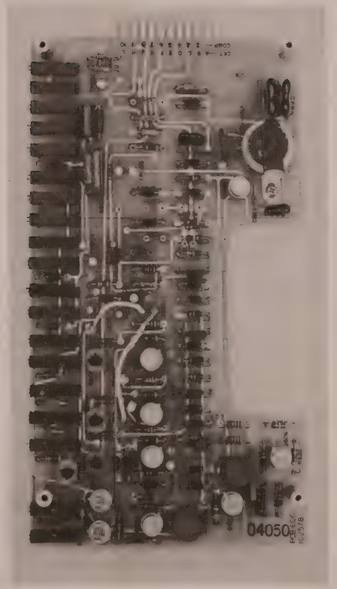




Figure 6-6. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Printed Circuit Board Number 500 Schematic Diagram and photograph.

| P601 | WIRED | PCB1 TERM | |
|---|---|---|---|
| 1 | J20 | | |
| 3 | | 81B | BLANKING PULSE |
| 6 | | 10 — R12 | |
| 7 | P1001-15 | | |
| 8 | | J201-3 | |
| 9 | P701-9 | | |
| 10 | P1001-11 | | |
| A | Q4-B | | |
| B | P701-B | 27C | +15V |
| | P701-C R62 R48 CR17 | | |
| C | | | |
| D | P701-D | 77 | GROUND |
| E | | 33C | -15V |
| F | P301-7 / 10 / J20 | | |
| H | P701-A | | +28V |
| J | | Q203-C | |
| K | P701-H | | |
| L | P701-8 | 78B | GROUND |

TB605 WIRED TO TB704
TB606 WIRED TO TB703
TB607 WIRED TO TB702
TB608 WIRED TO TB701



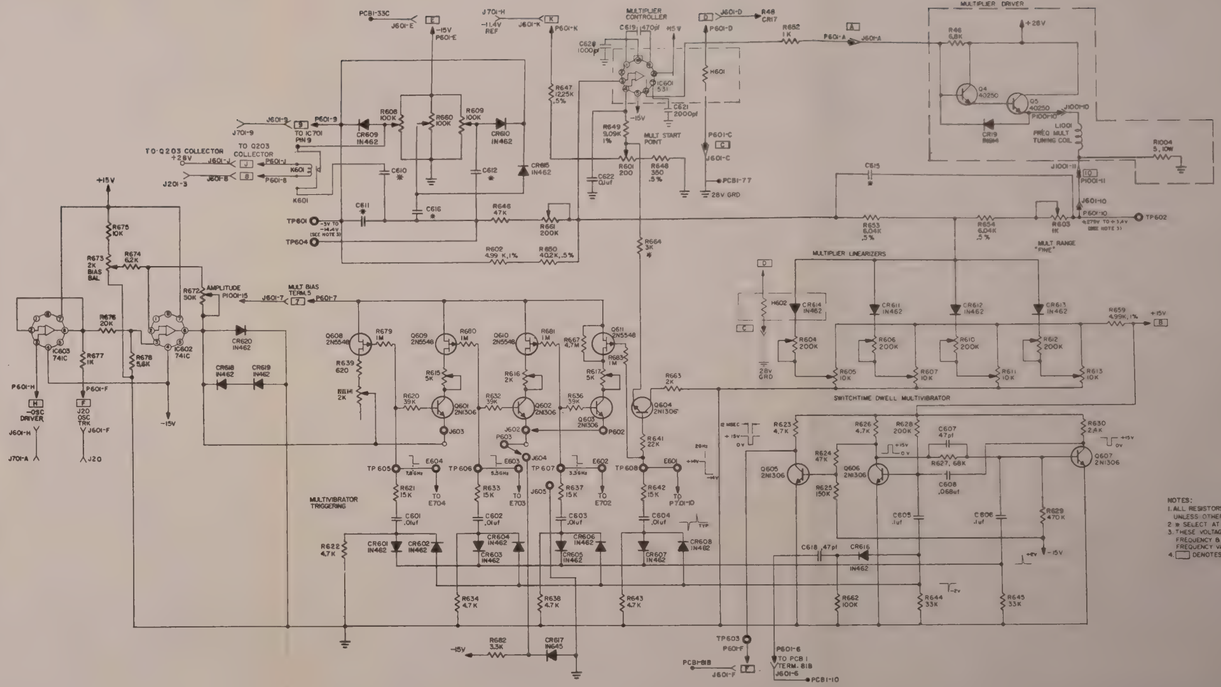
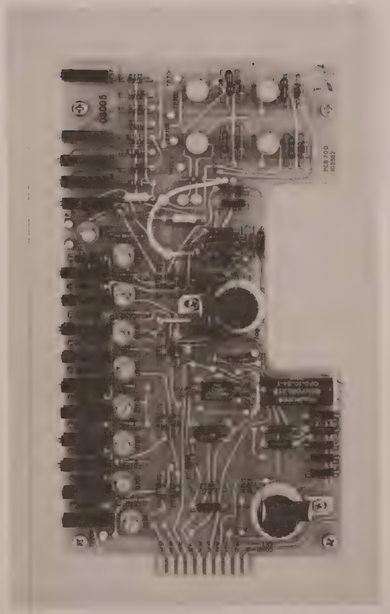



Figure 6-7. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Printed Circuit Board Number 600 Schematic Diagram and photograph.



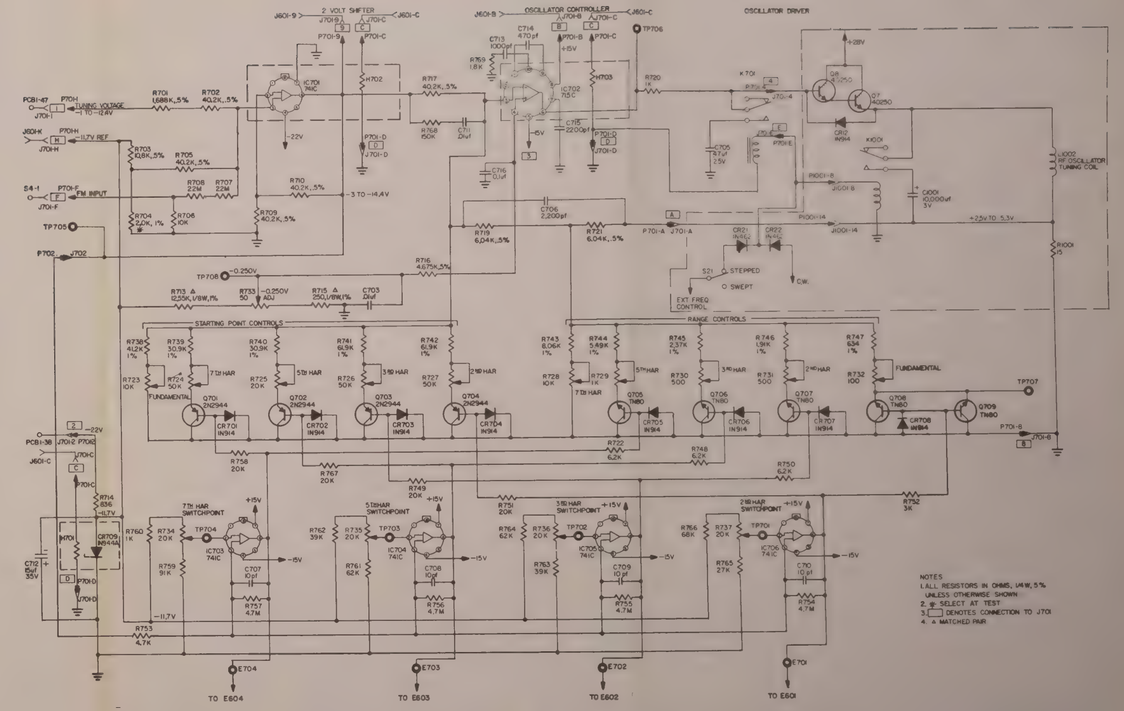


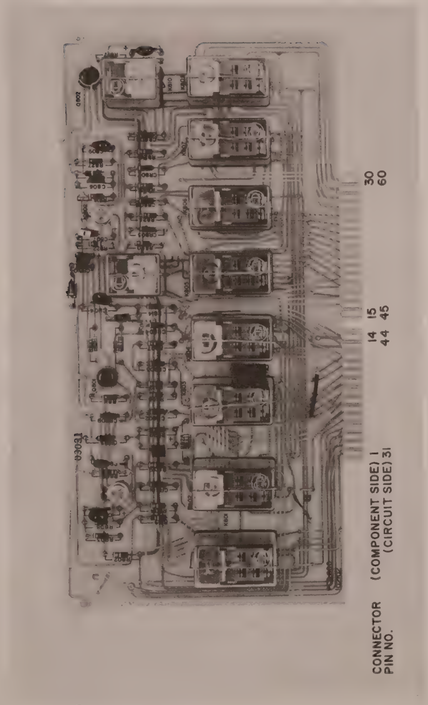

Figure 6-8. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Printed Circuit Board Number 700 Schematic Diagram and photograph.

P701 WIRED PCB1 TERM

| | | |
|---|---|---|
| 1 | 47 (R45 L1 C4) | |
| 2 | 38B | -22V |
| 3 | P601-E | |
| 4 | Q8-B | |
| 8 | P601-L | GROUND |
| 9 | P601-9 | |
| A | P601-H | |
| | J1001-14 | |
| B | P601-B | |
| C | P601-C | |
| D | P601-D | |
| E | 116 (CR21 CR22) | |
| | P1001-8 | |
| F | S4-1B | |
| H | P601-K | |

TB701 WIRED TO TB608
TB702 WIRED TO TB607
TB703 WIRED TO TB606
TB704 WIRED TO TB605

| P801 | WIRED TO | |
|---|---|---|
| 2 | 33B | -15V |
| 3 | J10 | |
| 4 | 67 — P101-20 | |
| 5 | S802-3 & 4 | |
| 7 | S802-2 | |
| 8 | S803-2 | |
| | S2 | |
| 9 | 19 — P101-5 | |
| 11 | 45 — L1 | |
| 12 | 69 — P201-21 | |
| 13 | S803-3 & 4 | |
| 14 | S804-2 | |
| | S804-3 & 4 | |
| 17 | 23 — CR22 | |
| 18 | S805-2 | |
| 19 | R34 | |
| 20 | F1 | |
| 21 | S807-2 | |
| 22 | PCB900-904 — IC902 | |
| 23 | S807-3 & 4 | |
| 24 | M2-2 | |
| 25 | M2-6 | |
| 26 | PCB900-902 — R41 | |
| 27 | R42 — F2-6 | |
| 28 | R42 — F2-2 | |
| 29 | 27B | +15V |
| 30 | 71 — P201-37 | |
| 31 | 77 | GROUND |
| 32 | S801-1 — 4A | +28V |
| 33 | S802-2 | |
| 34 | S801-3 & 4 | |
| 35 | 72 — P201-35 | |
| 36 | 64 — P101-17 | |
| 37 | 59 — P101-2 | |
| 38 | 60 — P101-1 | |
| 39 | R51 — F | |
| 40 | R51 — F — R39 | |
| 41 | 68 — P201-20 | |
| 42 | 73 — P401-19 | -13V |
| 43 | 70 — P201-22 | |
| 44 | 58 — P101-4 | |
| 47 | 32B | +13V |
| 48 | PCB900-908 | |
| 49 | 63 — P201-12 | |
| 50 | 61 — P201-8 | |
| 51 | S805-3 & 4 | |
| 52 | S806-3 & 4 | |
| 53 | S806-2 | |
| 54 | PCB900-906 | |
| 55 | M1-2 | |
| 56 | M1-6 | |
| 57 | 38A | -22V |
| 58 | S5-A3 | |
| 59 | S808-2 | |
| 60 | S808-3 & 4 | |



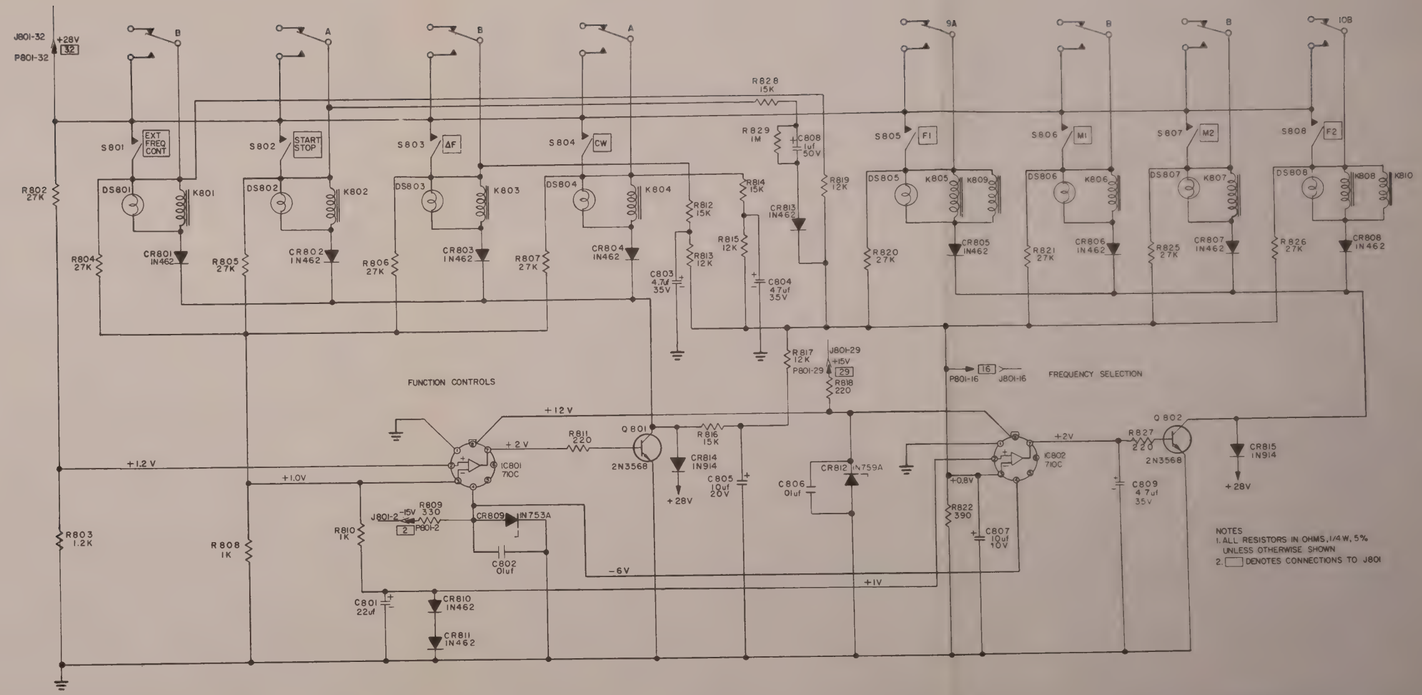
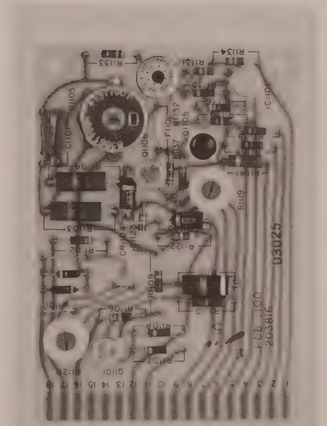




Figure 6-9. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Printed Circuit Board Number 800 Schematic Diagram and photograph.

P1001 WIRED TO

| | | | |
|---|---|---|---|
| 1 | 77 | | GROUND |
| 2 | 78A | | GROUND |
| 3 | 105 — K3 | | |
| 4 | 27C | | +15V |
| 5 | 107 — K3 | | |
| 6 | 33C | | -15V |
| 7 | 108 — R54 | | |
| 8 | P701-E | | |
| 9 | 4B | | +28V |
| 10 | Q5-E | | |
| 11 | P601-10 | | |
| | R56 R48 | CR17 | |
| 12 | | | |
| 13 | Q7-E | | |
| 14 | P701-A | | |
| 15 | P601-7 | | |
| 16 | 50 | | |
| 17 | | | SPARE |
| 18 | P701-10 | | |
| 19 | 77 | | GROUND |
| 20 | 113 — C16 / R60 | | |



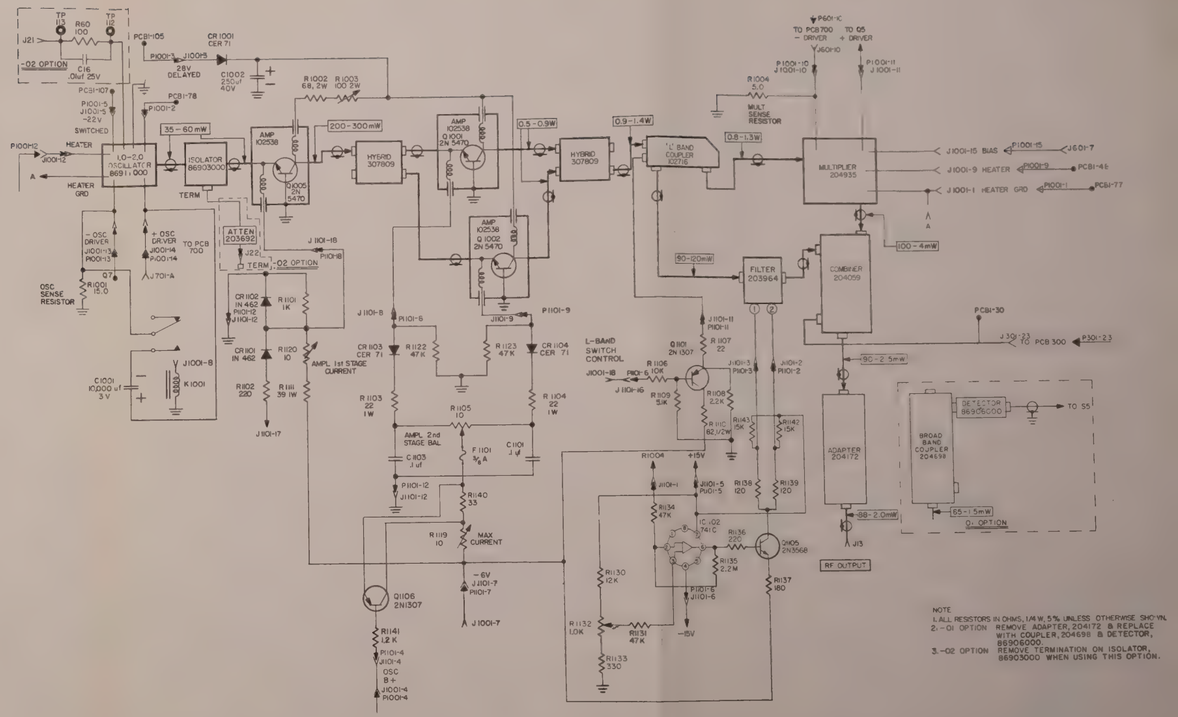
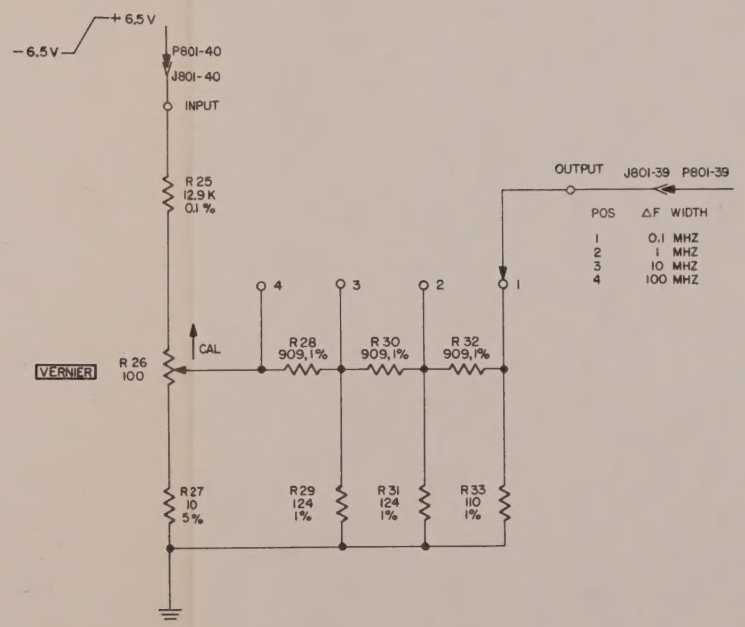
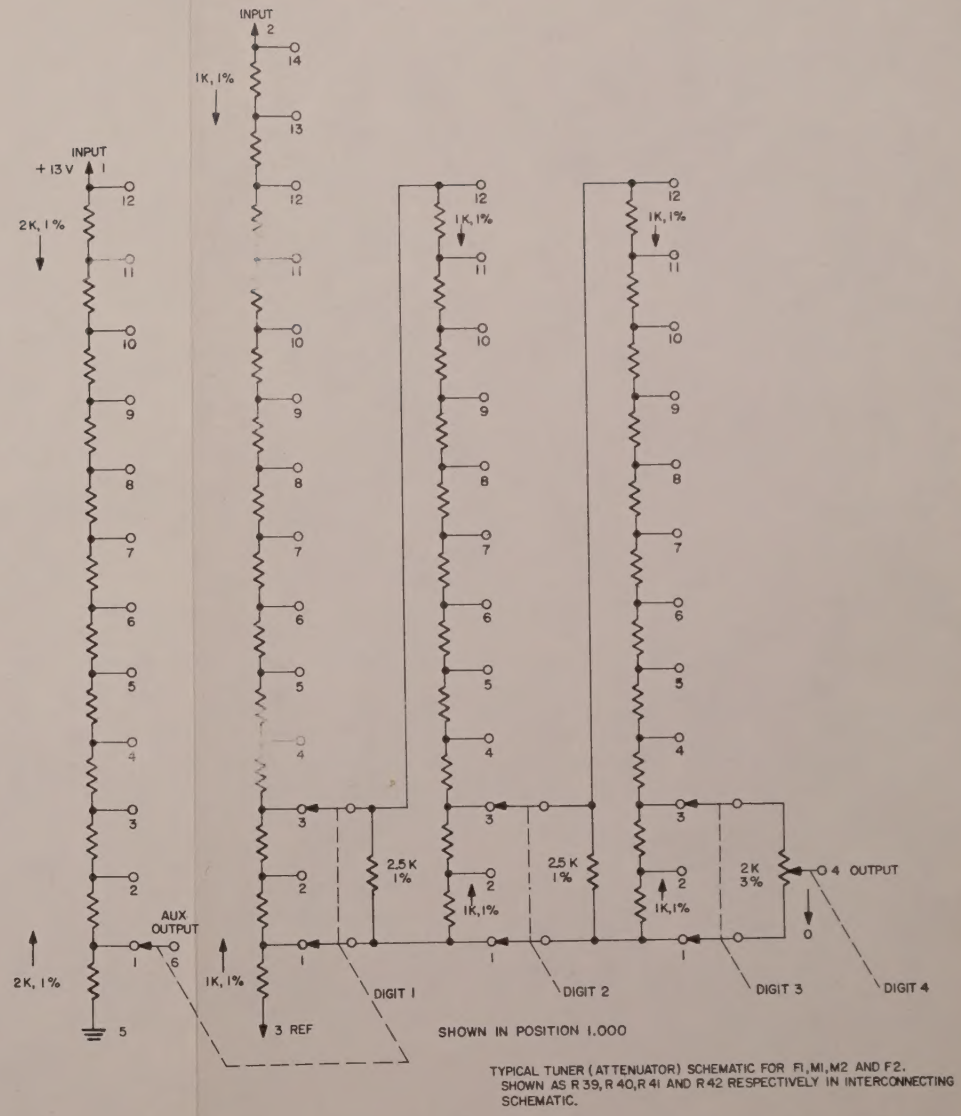



Figure 6-10. RF Section Schematic Diagram and Printed Circuit Board Number 1100 photograph




ΔF TUNER (ATTENUATOR)
SHOWN AS R51 IN INTERCONNECTING SCHMATIC




TYPICAL TUNER (ATTENUATOR) SCHEMATIC FOR F1, M1, M2 AND F2.
SHOWN AS R39, R40, R41 AND R42 RESPECTIVELY IN INTERCONNECTING SCHEMATIC.

Figure 6-11. Model 9500 1.0-12.4 GHz SOLID STATE SWEEPER Digital Display Counter Schematic Diagram.

MP MASTER
MA23730